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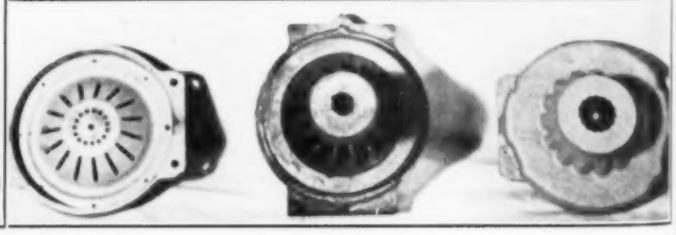
CLAY BUSH
Vice Pres. and Manager



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The Foundry Editorial

Foundry Operations Should Continue Upward Swing

OUTPUT of gray iron, malleable iron, steel and nonferrous castings in the United States increased during the last quarter of 1938, due in part to greater requirements of some consumer goods industries. Greatest improvement developed in foundries making castings for the automobile industry, where heavy buying followed introduction of 1939 models. Companies producing materials for numerous types of public works projects, merchant and warship construction, oil refineries, building construction, airplanes and other more or less specialized fields also have experienced marked improvement in orders for cast parts.

While operations have been lifted considerably above the low point of last summer, reports indicate the increase has not been commensurate with the reported upswing in general business during the past quarter. Late in December extensive variation in production schedules was noted in the different sections of the country and among companies making various classifications of castings.

With prospects for business considerably improved over a year ago, many foundrymen are viewing the year with noticeable optimism. In general the industry anticipates a further slow increase in orders during the early portion of 1939, as other customers are added to those already buying castings in fairly substantial quantities. Due to the basic character of castings in practically every manufacturing operation and the remarkable progress which has been made during the past decade in improving the properties of malleable, steel, gray iron and nonferrous castings, further recovery in practically any branch of American industry should be reflected at once in higher foundry operations.

Despite present financial difficulties among railroads, many believe that more foundry business will come from that source shortly. Machine tool foundries predict a gain of as much as 25 per cent for 1939, and foundries producing rolls and other steel mill equipment should enjoy a greater demand. Some expect agricultural equipment sales to improve in spite of low prices of farm products. Numerous other manufacturing industries should be in the market for more castings as the year progresses.

Foundry operations in 1939 should show considerable improvement over 1938.

Real Selling Is Needed

FOR a number of years THE FOUNDRY has emphasized the need for more intelligent sales efforts in the foundry industry. Undoubtedly progress has been made and the tremendously improved cast products of today in many instances are being sold on the basis of performance in service.

Perhaps sales methods need further modernizing. Is it possible the spotty situation in foundry operations at present bears a definite relationship to selling?

The following quotation from a recent Sunday evening broadcast by W. J. Cameron of the Ford Motor Co. presents food for thought:

What is needed for 1939 is *uninspired salesmanship*—men and women who go to their job as a farmer goes to his plowing. He does not attend a preliminary "pep session" in the farm kitchen to "inspire" him for his work, he simply puts himself between the handles of his plow and *plows*—daily, doggedly, deliberately plodding and plugging along, not wondering about the "upturn", but steadily turning up the furrows. It's not a question of enthusiasm, it's a question of *persistence based on knowledge* that, if not now, then later, every investment of effort yields its return. We do not say that *if* you do this you will get results; we say that those who do this *are getting* results. *How else do you think this country has lived through these last few years?*

Constructive Ideas

THE following two exceedingly short editorials in the advertising pages of the December issue bear repeating:

It's not the equipment but the lack of it that costs you money.

Now is the time to install cost-reducing machinery.

Frank G. Steinbach
Editor

New Steel

This article is from a paper presented before the recent regional foundry conference at Rolla, Mo., under the sponsorship of the St. Louis District Chapter of the A.F.A., and the Missouri School of Mines and Metallurgy. The second and concluding section of this paper will be presented in an early future issue of The Foundry

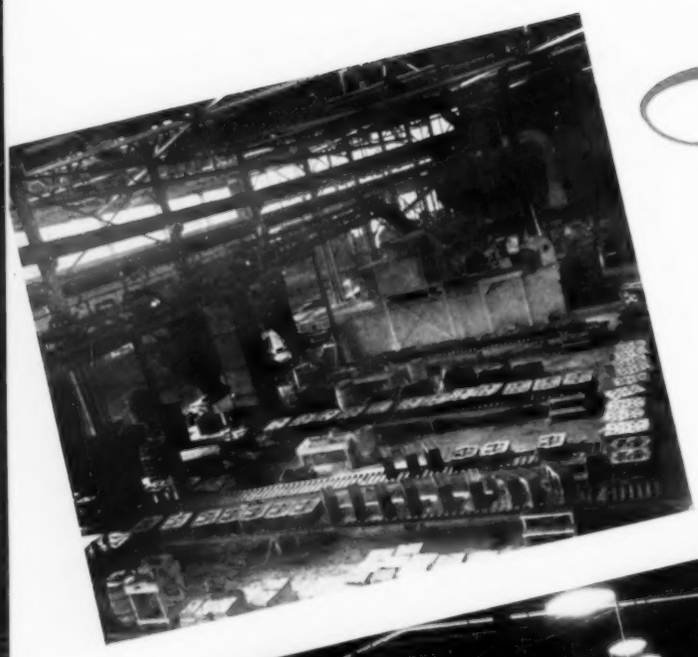


Fig. 1 (Upper Left)—Partial birds-eye view of the foundry. Fig. 2 (Above)—In the patternshop plenty of room is allowed around each machine so that the men can work without interference. Fig. 3 (Right below)—Tapping a heat from the electric furnace

FOR American oil refinery practice, fittings regularly are demanded to operate at temperatures in the vicinity of 1050 degrees Fahr. and up to pressures of 2000 pounds per square inch. In the dewaxing of oils, fittings are required to stand up to a temperature of minus 75 degrees Fahr. and a pressure of 2000 pounds. In 1935 the Key Co., East St. Louis, Ill., completed a hydrogenation unit for Cie Francaise des Essences Synthetique, Lievin, France, designed to operate at a temperature of 1200 degrees Fahr. and at a pressure of 3500 pounds per square inch. Another unit was built in 1938 to operate at a temperature of 1250 degrees Fahr., and at the extremely high pressure of 5400 pounds per square inch.

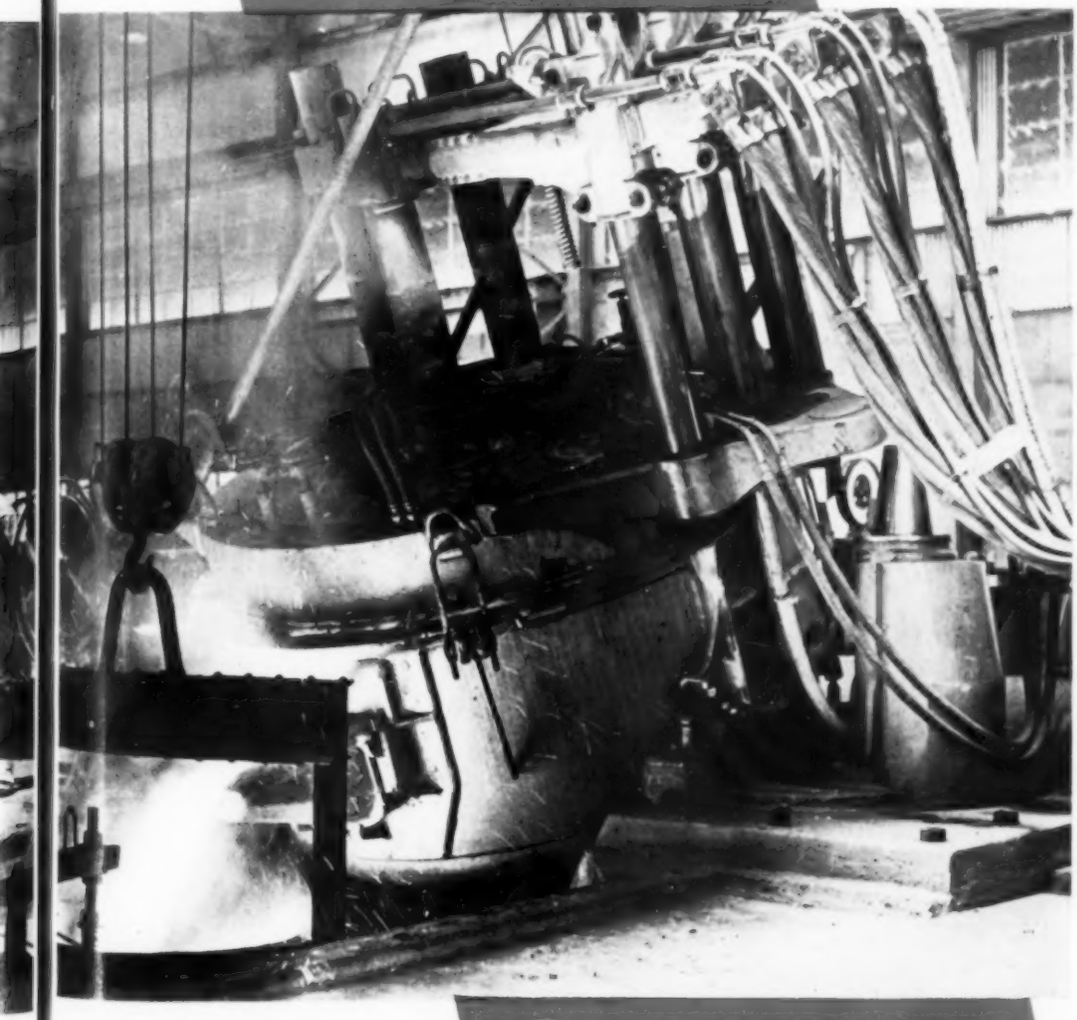
Aside from the well known flanged fittings, tees, ells, valve bodies, etc., used in high pressure pipe work, the return bend or header box used in the oil still is the most important, and generally the most troublesome to make. The problem of heating coil layout varies greatly with different refineries. Consequently, the types of fittings required are very numerous and not subject to standardization as are pipe fittings. The problem of tube connections and cleanout or hand hole closures varies with the temperature ratings, pressures, type of still, type of crude oil and many other factors.

Successful casting of various complicated designs may require foundry technique somewhat different to that ordinarily applied to general industrial castings. The case is aggravated further by the fact that most of these fittings are alloy steels, specifically developed to meet conditions encountered in modern oil refinery practices. For the most part these steels are very tender and temperamental.

In almost no other industry has met-

Foundry Meets Exacting Conditions

By LEE E. EVERETT
Foundry Superintendent
Key Co., East St. Louis, Ill.



allurgy played the part in the development of processes and practices as it has in the petroleum industry. Yet, today it is probably the greatest limiting factor to further development. The oil industry ever is endeavoring to reach higher temperatures and pressures. Metallurgists are endeavoring to formulate metals to meet these conditions. We have to be content for the present with materials that will permit operating temperatures up to 1200 degrees Fahr. and operating pressures up to 5000 pounds per square inch. These high pressures and temperatures tend to produce a gradual deformation of the materials, known as creep, not directly related to room temperature strength.

Designers generally are limited to a high temperature stress resulting in not over 1.00 per cent creep in 100,000 hours service. In addition to this stress resistance that must be built into the fittings, we have in some crude oils a sulphur form and content which is highly corrosive. The chlorine content of the water frequently associated with crude oils and certain intentionally added or applied chemicals are highly corrosive under some operating conditions.

A great variety of alloy steels have been developed to withstand the stresses, the erosive and corrosive conditions. They generally are specified in accordance with the actual hazards to be overcome, with due regard for true economical application. Without detailed statement concerning actual characteristics, the generally used cast alloy steels for high temperature, high pressure work, listed in order of application for successively higher temperatures and pressures and increasing corrosion resistance, are approximately as shown in Table I. Many other compositions are used for refinery fittings, but the compositions shown cover the majority of the installations.

The steel foundry has been so close to metallurgical developments in the oil refinery industry that most of the alloy steels in this field are produced as successfully by casting as by forging. Some of the newer alloys are available only in castings. They can be forged only with great difficulty, if at all. In many ways castings are more desirable than forgings of similar composition, granting that both are produced by proper and appropriate practice and technique.

Steel unquestionably is improved in ductility at room temperature by forging or rolling through the

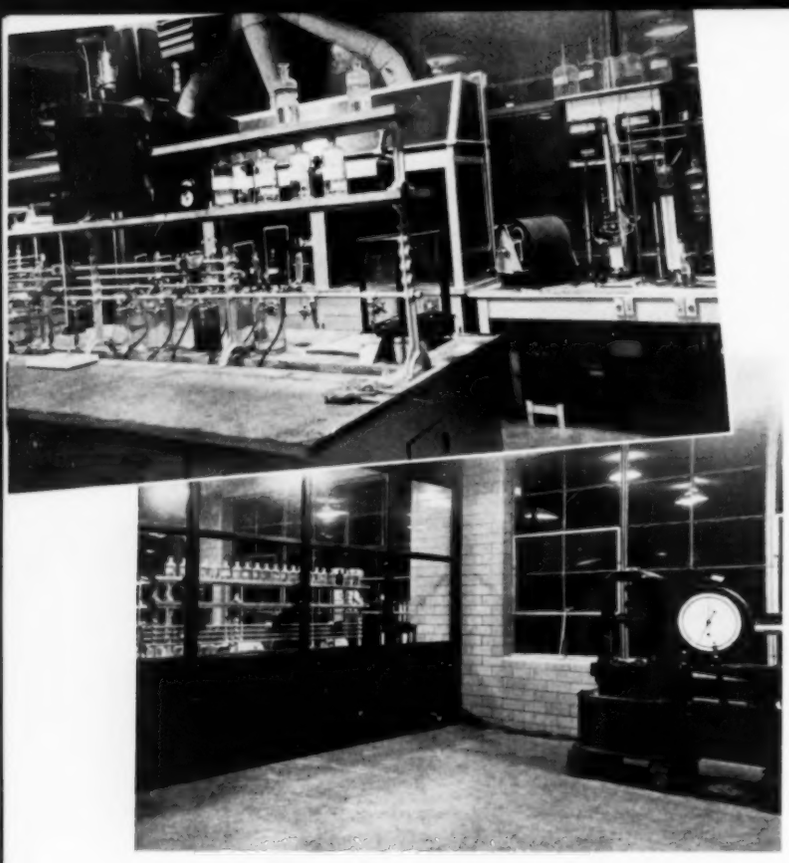


Fig. 4 (Top)—Completely equipped chemical laboratory provides means for accurate control of product. Fig. 5 (Bottom)—Physical testing laboratory adjoins the chemical laboratory

mechanical refinement of the grain structure. However, effectiveness of this treatment, as evidenced by tensile and particularly by impact test, is not exceptionally great if the axes of the test pieces are taken in direction not coincident with the direction of flow of material under the hammer or roll. In a properly made casting the physical properties are approximately the same in all directions.

Coarser grain structure of the casting is believed to give it inherently greater resistance to gradual distortion at high temperatures (creep strength) than forged material of the same composition. The same factor probably gives the cast metal generally a higher room temperature yield ratio, although accompanied by lower ductility values than the forged or rolled material. Erosion and—at least to some extent—corrosion is believed to be resisted better by the cast metal. This is presumed to be partly on account of the much more thorough degasification of the cast metal, due to the nature of the casting process, and partly on account of the larger granular structure.

In the manufacture of ingot steels the minor gas cavities are compressed in the subsequent rolling process. They may exist in the finished steel as small seams, streaks or laminations not ordinarily detected, but certainly of importance in connection with erosive or corrosive life. Not concerned directly with application, but certainly of economic importance is the fact that under some conditions—particularly finishing cuts—cast metal may machine more readily than forge material of similar composition and brinell hardness.

Steel Meets Customer's Requirements

Normally, the steel foundry produces castings for oil refinery fittings in compliance with the customer's specifications and consequently is not responsible for the life of the fittings due to erosive or corrosive conditions, for the metallurgical characteristics of the metal, or concerned with the application of a special alloy for specific conditions beyond observance of proper practice in producing and handling it.

However, the foundry is completely responsible for the metallurgical and physical integrity of its product. Soundness, cleanliness, and accuracy of the casting, metal composition, degasification, pouring practice, fettling and cleaning practice, heat treatment and final inspection are of fundamental importance.

Evidently any fitting for handling explosive or inflammable materials at high temperatures and pressures must be absolutely sound. Castings must be cleaned thoroughly and must be smooth on the inside to prevent turbulence and over heating locally in the oil stream and to prevent the introduction of foreign material, scale or sand in the oil. Cleanliness also permits proper inspection. Accuracy is of prime importance. Uniform wall thickness insures maximum life of the fittings. Weak spots or thin sections might cause premature failure. Accuracy particularly is required in return bends that must nest on close centers. Uneveness or variation in size and center distance prevent proper assembly of the still coil.

Chemical analysis must be restricted to close limits to get the expected physical properties and corrosion resistance. Thoroughly degasified metal must be used to minimize the possibility (*Please turn to page* 71)

Table I

Basic Type Steels Used for Oil Refinery Service

Material	Chemical				Physical					Pounds Allowable Stress Limit for 1.00 Per Cent Creep in 100,000 Hours at Degrees Fahr.			
	Carbon	Chromium	Nickel	Molybdenum	Yield Point	Tensile	Elongation	Reduction of Area	Brinell Hardness	800	900	1,000	1,200
Carbon steel	0.30	....	....	....	45,000	74,000	26	35	137	9,350	4,600	2,200	400
Carbon-Molybdenum	0.28	....	....	0.50	55,000	85,000	20	40	175	15,500	9,350	3,600	450
Nickel-Chromium-Molybdenum	0.30	0.80	2.00	0.40	75,000	105,000	21	40	197	17,875	10,675	4,725	1,600
Chromium-Molybdenum	0.28	2.00	....	0.50	60,000	85,000	22	40	202	16,850	16,025	7,100	1,350
Chromium-Molybdenum	0.22	5.00	....	0.50	75,000	105,000	20	45	195	21,000	14,700	6,100	1,100
Chromium-Molybdenum	0.12	9.00	....	1.50	50,000	80,000	25	50	190	.....	24,750	5,800	1,600
18-8	0.15	18.00	8.00	....	.....	80,000	40	45	...	14,725	14,100	13,000	4,550

International Foundry Congress

LONDON, largest capital in the world, will be the gathering place for foundrymen the world over during the 1939 International congress which will be held from June 12 to 30. Members of the American Foundrymen's association who attended the 1929 congress will remember the interest and variety of program offered at that time, and the forthcoming meeting perhaps will exceed the previous congress.

Tentative program arrangements indicate that the first week will be spent in London where the opening ceremony will be held under the patronage and in the presence of leading government, civic, and industrial personalities. Three days will be devoted to presentation and discussions of papers. The remaining time will be given up to plant visitations in the vicinity of London. Program for social gatherings and entertainment in the evenings include a reception on Tuesday evening, banquet on Wednesday evening, and reception on Thursday evenign. Friday will be devoted to an all-day excursion up the River Thames and a visit to Windsor castle.

Post-congress Tour Arranged

Post-congress tour is arranged to last one or two weeks according to the time visitors have at their disposal. The tour will begin on Sunday, June 18, and include visits to Sulgrave manor, ancestral home of George Washington's family, and to the Shakespeare country. The party then will go to Birmingham, Derby, Sheffield and Manchester. Special visits will be arranged for the ladies.

Second week of the tour will commence on Saturday, June 24, the group leaving Manchester for Windermere, a noted beauty spot in the lake district. Points of interest to be visited include Glasgow, River Clyde, Edinburgh, and Newcastle-upon-Tyne. Friday evening, June 30 the party will leave Newcastle on the Coronation, one of the fastest trains in the world, arriving in London that night. Plans for American participation in the International Congress will be presented in an early issue of THE FOUNDRY.

Tentative program of meeting and tours follow:

Friday and Saturday, June 9 and 10

Overseas visitors arrive in Great Britain and proceed to London.

Sunday, June 11

Informal hospitality and sightseeing under guidance of members of I. B. F. and their ladies. Garden party at the home of Barrington Hooper, C. B. E., and Mrs. Hooper.

Monday, June 12

Registration office and information bureau will open at Dorchester hotel, Park Lane.
Afternoon—Committee, council and business meetings of the I. B. F.
Evening—Informal arrangements for sightseeing.

Tuesday, June 13

Morning—Official opening of the congress. The fourth Edward William's lecture by Prof. W. L. Bragg, University of Cambridge.
Afternoon—Reading and discussion of papers.
Evening—Reception.

Wednesday, June 14

Morning—Reading and discussion of papers on nonferrous subjects. Visits to foundries in London area.
Afternoon—Reading and discussion of papers on ferrous subjects.
Evening—Banquet at Dorchester hotel.

Thursday, June 15

Morning—Reading and discussion of papers. Visits to foundries in London area.
Afternoon—Reading and discussion of papers, and visits to foundries in London area.
Evening—Reception at Dorchester hotel.

Friday, June 16

All Day—Visits to foundries.

Saturday, June 17

All Day—Excursion to Windsor castle and on the River Thames. Congress closes.

(*Please turn to page* 80)

"Specs"

By
JOHN HOWE HALL
Philadelphia

WHEN the writer succeeded the late R. A. Bull as secretary of the Technical Specifications Committee, Steel Founders Society of America, he was asked to prepare a tabulation of the requirements of the principal current specifications for carbon steel castings. The result is the somewhat appalling table presented as Table II on page 84 which has been distributed as a technical bulletin to the membership of the Steel Founders society.

By its kind permission it is reproduced with a summary of the chemical requirements classified as to elements in Table I on page 83 and a chart on page 27 for the use of those who prefer diagrams to tables for ready reference. It will be noted that four classes of steel listed as *alloy* are included in these figures, for the reason that they are in the same specifications as the carbon steel classes, and it seemed inadvisable to separate them.

Tabulated According To Physical Properties

In Table II on page 84, the physical and chemical requirements first are listed under the individual specifications; the physical properties then are re-tabulated in groups of equal tensile strength, with the idea of showing at a glance the specifications that can be met by any particular heat of steel.

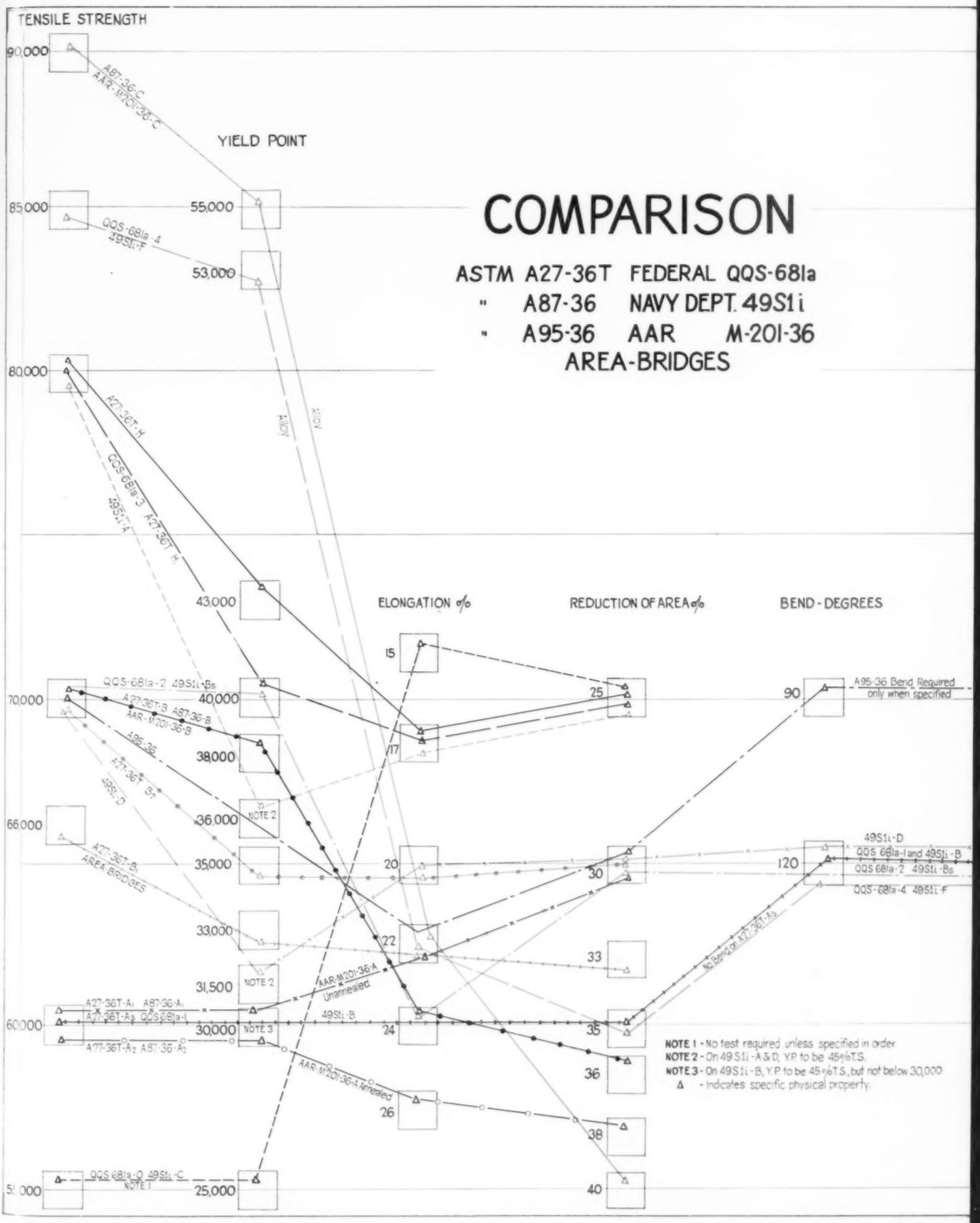
By the use of this second part of the table, it is ascertained readily that a heat about to be made, and which will have a tensile strength, for instance, of 70,000 to 80,000 pounds per square inch, can be used to fill orders under a variety of specifications as listed. At the same time, the other physical properties that must be satisfied, if this heat is to be used to meet any particular specification and class, are ascertained readily.

Certain of the current federal and navy specifications, however, include requirements as to chemical composition, in addition to the commonly required limits for phosphorus and sulphur; reference either to the detailed list or to the summary of chemical requirements tabulated by elements, will show immediately what restrictions are there imposed upon carbon, copper, nickel and *other elements*. In addition, restrictions on maximum manganese content are imposed for most of the classes of steel covered by these specifications.

Restrictions Placed on Chemical Content

For instance, a heat of steel that will test 70,000 pounds per square inch tensile strength, and give the other physical properties required, can be used to make castings under specification QQS681a, class 2, only provided the nickel does not exceed 1 per cent, the copper 0.50 per cent, or the silicon 0.45 per cent. Moreover, the manganese must not exceed 0.70 per cent nor the carbon 0.35 per cent, except that as the carbon is reduced below the maximum of 0.35 per cent, the manganese may be increased by 0.025 per cent for each reduction of 0.01 per cent carbon. Similarly, an increase of manganese corresponding to a decrease in carbon is allowed for castings made to meet the requirements of specification QQS 681a, class 1, with the further restriction that in no case may the manganese exceed 0.85 per cent.

To the author, the variations in the physical properties are followed more readily by reference to the chart on page 27 which is, of course, a graphical method of showing the data in part two of Table II. In the 60,000 pound per square inch tensile group, for instance, the nine classes covered, each with a yield point of 30,000 pounds per square inch, readily are seen to be divided into three sub-groups, (*Please turn to page* 83)


TENSILE STRENGTH
YIELD POINT
ELONGATION %
REDUCTION OF AREA %
BEND - DEGREES
COMPARISON
ASTM A27-36T FEDERAL QQS-68la
" A87-36 NAVY DEPT. 49S1i
" A95-36 AAR M-201-36
AREA-BRIDGES
90,000
85,000
80,000
70,000
66,000
60,000
55,000
53,000
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A87-36-C
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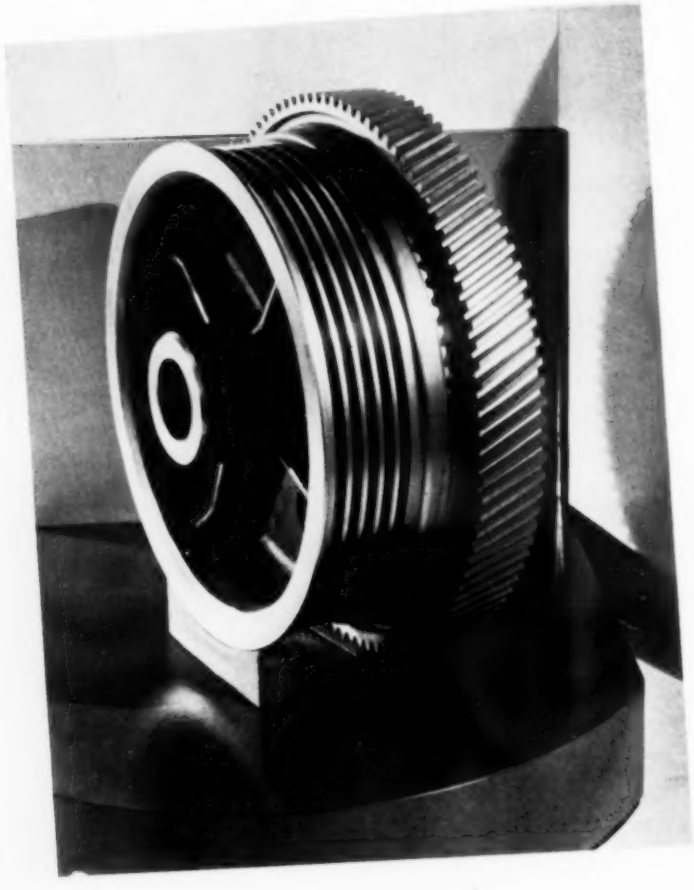
A27-36T-H
QQS 68la-3 A27-36T-H
49S1i-A
QQS-68la-2 49S1i-Bs
A27-36T-B A87-36-B
AAR-M201-36-B
A95-36
A27-36T-B
49S1-D
A27-36T-B AREA-BRIDGES
NOTE 2
NOTE 2
A27-36T-A1 A87-36-A1
A27-36T-A2 QQS-68la-1
A27-36T-A2 A87-36-A2
NOTE 3
AAR-M201-36-A Unannealed
49S1i-B
AAR-M201-36-A Annealed
QQS 68la-D 49S1i-C
NOTE 1
A95-36 Bend Required only when specified
49S1i-D
QQS 68la-1 and 49S1i-B
QQS 68la-2 49S1i-Bs
QQS-68la-4 49S1i-F
NOTE 1 - No test required unless specified in order
NOTE 2 - On 49S1i-A & D, Y.P. to be 45% T.S.
NOTE 3 - On 49S1i-B, Y.P. to be 45% T.S., but not below 30,000
Δ - Indicates specific physical property

SHOP Problems in L

This is the second and concluding part of a paper by A. P. Lee, Bethlehem Steel Co., presented before a meeting of the Connecticut Foundrymen's association at Meriden, Conn. The first part appeared in the December issue of The Foundry

AS INTERNAL shrinkage, and sometimes external shrinkage are the causes of so much trouble, it perhaps is advisable to give this problem more consideration at the start of a new job. Core expansion sometimes is relied upon to help overcome internal shrinkage. Large cylinders can be used as an illustration. These cylinders are cast on end in dry sand, stuffing box end up.

If the mold is rammed firmly and dried bone dry in an iron or steel flask, so that there is no chance of strain, the expansion of the cores will crowd the metal. Gates and risers are chilled as soon as the mold is full to prevent the iron from being forced out. Crowding of the metal by expansion of cores forces the metal into places where a void may exist. No good will come from this practice unless the flask and mold are able to withstand the pressure.



Utilizing core expansion as an aid to feeding is possible in any job heavily burdened with cores. The larger the cores, and the more there are of them, the greater the benefit.

Molding Position Is Important

Irons that shrink externally (settle away from the cope) usually are free from internal shrinkage and are very reliable for gears. In certain castings external shrinkage is as serious as internal shrinkage in others. The way the casting is made often is a factor of importance. Take a casting 2 feet long, 1 foot wide and 5 inches thick as an illustration. The simple way to cast this is on the flat. The chances are that the top surface will settle if the carbon content is low enough to produce a casting of uniform density.

Made on edge the same casting can be risered successfully and there will be no settling. If the castings are finished all over, normal finish allowed, the one made on edge will be freer from defects. Pouring temperature, head pressure, risers and mold strain are important factors when dealing with either external or internal shrinkage.

Most castings have to be machined. Low carbon irons are dense and tough. If they were not, there would be no advantage in making them. The strengths, density, wearing qualities and appearance asked for by buyers depend upon these properties.

Higher carbon irons are full of small spaces containing graphite. Graphite is a lubricant. The open grain

Low Carbon Iron

By A. P. LEE
Bethlehem Steel Co., Bethlehem, Pa.

structure and the presence of graphite consequently make them easy to machine. These irons proved unsatisfactory for a great many castings because engineers were asking for qualities which the irons do not possess. The first step was to close the grain by lowering the silicon and using chills.

Of course, this refined the grain, but it was not the answer, because it neither provided uniform density nor sufficient strength. The next move was to use steel scrap in small quantities because it tended to toughen the castings. During this period the machine shops complained about the difficulties encountered in machining. Today, when the foundryman has learned to make iron which is approaching what the engineer wants, the machine shops still are complaining.

Machine Shops Improve Technique

Machine builders specify these irons because they need them. At the same time they like to maintain piece work rates set for the softer irons. Some machine shops are improving their technique and keeping in step with the foundryman and the metallurgist. These shops find that they can make good time, and that it is not necessary for machine costs to increase to any great extent. Other shops have done nothing about it and continue to complain.

This question of machinability is a difficult one to meet because a certain iron considered readily machinable in one shop may be looked upon as difficult to machine in another.

The foundry doing jobbing work is probably in the most difficult position. The buyer (because he is a buyer) expects to get everything he asks for, whether he is reasonable or not. The weapon usually employed is "If you can't give me what I want someone else will." Naturally the foundryman does not want to lose a customer. He tries to make the casting more machinable. The result of that practice is not always satisfactory.

The captive foundry is in better position because someone in the organization is responsible for all operations in the plant. If the foundry produces the type of iron the engineering department and the management desire the chances are that the machine shop will try to hold down costs by doing what is necessary. A recent experience will illustrate this.

A large shop machining alloy castings for high pressure equipment continually complained because they could not run the machines as fast as formerly. The general manager complained about costs and demanded that the foundry do something. The foundry superintendent told his manager that he could soften the iron, but did not want to do so because he feared it would result in a high percentage of loss due to leakers which at that time were almost unknown. Finally the castings were softened and the leakers immediately increased in number.

At this point assistance was called in from outside. An iron was selected which stopped the losses, but complaints then were made that the iron was too tough. When questioned if anything had been done in the machine shop to help the situation, the management asked: What can be done? The result was that a meeting was immediately called, to study tools and machine speeds.

Investigation showed that tools going to the machine operators were in good condition and well designed, but the operators were allowed to grind them until they were not suitable for the work. Machine speeds were high and feeds light. Investigation then was started to find more suitable tool steels. As a result, they are now able to machine the irons in question and consider them satisfactory on that point. (*Please turn to page* 74)

BY G. A. TIMMONS, V. A. CROSBY
AND A. J. HERZIG
Climax Molybdenum Co., Detroit

AMONG the 15 irons examined as indicated in Tables I, II and III which appeared in the December issue, 10 developed tensile strength in excess of 70,000 pounds per square inch and 6 showed more than 80,000 pounds per square inch in 1.2-inch section. In the 2-inch section, there were 5 irons which exceeded 70,000 pounds per square inch tensile strength. The two irons exhibiting the best tensile properties were:

Heat No. 1267—82,280 pounds per square inch in 1.2-inch section and 76,550 pounds per square inch in 2-inch section.

Heat No. 1268—85,800 pounds per square inch in 1.2-inch section.

The plain cast iron, heat No. 1299, which might be termed the base iron for heats No. 1265 to 1268 and 1299 to 1305 showed a tensile strength of 69,800 pounds per square inch in the 1.2-inch section and 54,680 pounds per square inch in the 2.0-inch section. However, this iron showed a low impact resistance (44.4 feet pounds).

Irons exhibiting the highest tensile strengths in both 1.2-inch and 2.0-inch sections are alloy irons containing 1 per cent each of manganese, and molybdenum, with 1 per cent nickel or copper, and (heat No. 1301) 1 per cent molybdenum with 1.5 per cent manganese.

The same heats showed the greatest impact resistance. In the case of four heats, (Nos. 1265, 1267, 1268 and 1305) the bars failed to break, but were permanently deformed by the impact of 120 feet pounds. See Fig. 19.

Heat No. 1267 developed the best combination of properties, indicating the highest strength in the 2-inch section. The impact bar from this heat failed to break at 120 feet pounds. It also ranked third in tensile strength for the 1.2-inch section. An interesting study regarding the effects of alloys can be made from heats No. 1299, 1266, 1265 and 1305 as shown in Table V.

The microstructure of plain cast iron (heat No. 1299 Figs. 5 and 2 in the December issue), shows a fine graphite flake, well distributed throughout a matrix of pearlite. Some free ferrite has been formed in both 1.2-inch and 2.0-inch sections. The addition of 1.00

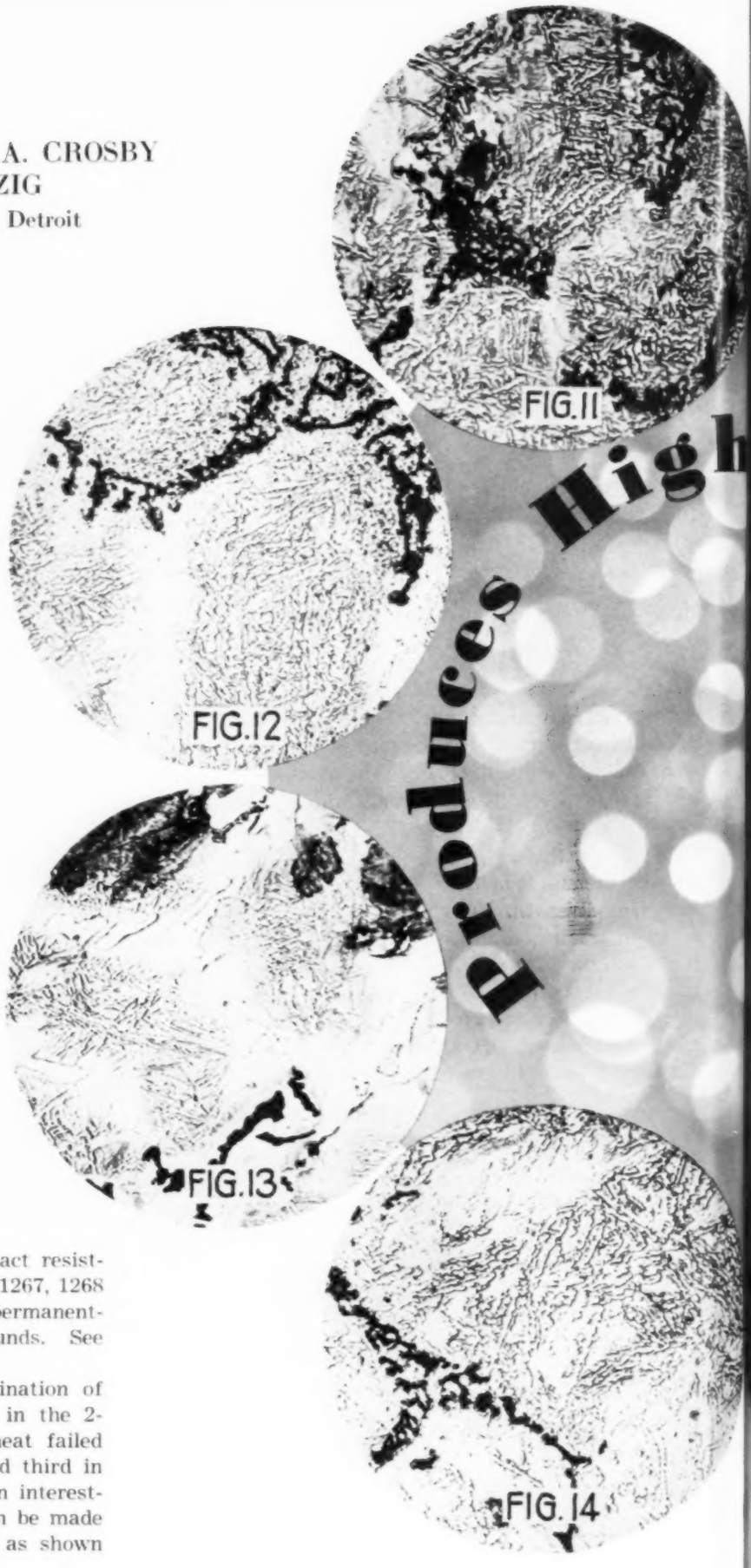


Fig. 11—Heat No. 1228, etched in 2 per cent nital, 500 diameters, 1.2-inch section. Fig. 12—Heat No. 1228, etched in 2 per cent nital, 500 diameters, 2-inch section. Fig. 13—Heat No. 1229, etched in 2 per cent nital, 500 diameters, 1.2-inch section. Fig. 14—Heat No. 1229, etched in 2 per cent nital, 500 diameters, 2-inch section

Strength Iron

This is the second and concluding article of a series of two on an investigation conducted by the authors on the effect of molybdenum on super cast irons. The first article appeared in the November issue

FIG. 15

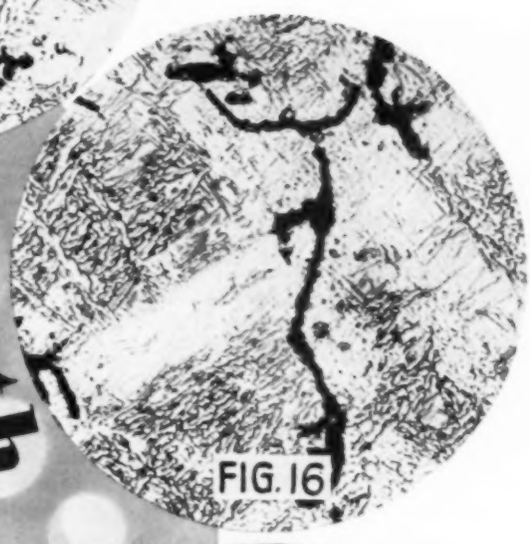


FIG. 16

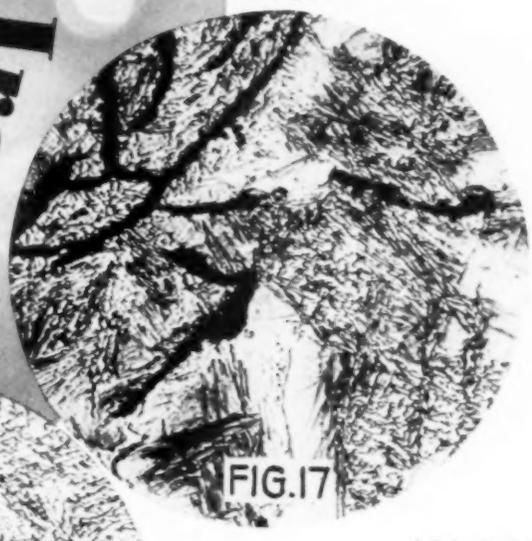


FIG. 17

FIG. 18

2-inch section. Fig. 15—Heat No. 1230, etched in 2 per cent nital, 500 diameters, 1.2-inch section. Fig. 16—Heat No. 1230, etched in 2 per cent nital, 500 diameters, 2-inch section. Fig. 17—Heat No. 1231, etched in 2 per cent nital, 500 diameters, 1.2-inch section. Fig. 18—Heat No. 1231, etched in 2 per cent nital, 500 diameters, 2-inch section

per cent molybdenum (heat No. 1266) increased the brinell hardness, raised the tensile strength and impact resistance, changing the lamellar-pearlitic matrix to an acicular matrix with numerous areas of fine lamellar pearlite well distributed throughout the cross section of the 2-inch bar (Figs. 3 and 4, December issue).

The addition of 1.00 per cent nickel to the 1.00 per cent molybdenum iron (heat No. 1265) apparently produces a more martensitic structure in the 2-inch section due to its effect on the transformation rate causing the austenite to transform at lower temperatures as the casting cools (See Figs. 5 and 6, December issue). The tensile strength in the 1.2-inch bar was increased but lowered appreciably in the 2-inch bar. Impact resistance and brinell hardness were raised in the 2-inch section, while the impact resistance of the 1.2 inch section was lowered.

The addition of 1.00 per cent copper to 1.00 per cent molybdenum iron (heat No. 1305) had an effect similar to nickel except that it promoted the formation of sharply defined acicular martensite with some massive carbide in the 1.2-inch test bar (Fig. 8, December issue), producing uniform acicular matrix in the 2.0-inch section (Fig. 9 December issue). (Given analysis is for 2.0-inch test bar, hence free carbide in 1.2-inch bar is not indicated).

The irons containing over 1.50 per cent manganese exhibited high hardness, were difficult to machine, and showed fairly low tensile strength and low impact resistance. While heat No. 1301, containing 1.0 per cent molybdenum and 1.5 per cent manganese, showed an equally high tensile strength in the 1.2-inch section, in the 2.0-inch section it showed a lower tensile strength than heat No. 1267, containing 1.0 per cent molybdenum and 1.0 per cent nickel with only 1.0 per cent manganese. Impact strength of heat No. 1301 was slightly less than that of heat No. 1265, and the material was somewhat harder.

Heats No. 1228 to 1231 showed the effects of chromium and vanadium when added to 1 per cent molybdenum, 1 per cent nickel cast iron. The addition of 0.20 per cent chromium (heat No. 1229) lowered the transverse strength, the deflection (*Please turn to page* 86)

By N. K. B. PATCH

Nonferrous Foundry Has Wide Range Of Alloys Available

WHILE it is obvious that a complete table of all of the compositions cast in the nonferrous foundries in the United States and Canada would be cumbersome, and contain numerous alloys that differ but slightly, the author has endeavored to prepare a tabulation of those most well known and commonly used. Experienced nonferrous foundrymen will recall that from time to time slight changes are made in compositions of standard alloys to meet specific needs, or because of some particular preference. Even in this tabulation a few of the variations of the standard 85 per cent copper, 5 per cent tin, 5 per cent lead, and 5 per cent zinc are included.

Lists Milling Points of Alloys

In Table I, the compositions with the approximate melting point and the range within which the pouring temperature will be most common are listed. Columns indicating the standard specifications which cover the particular composition also are included. It should be noted also that the melting point is given as a range within the limits indicated because the ratio of the different elements in the composition vary slightly.

Proportion of the different elements in a given alloy of course change the melting point of the alloy since each of the different elements has a definite temperature at which it becomes molten. Melting points of eight of the constituent elements in nonferrous alloys are: Aluminum, 1217 degrees Fahr.; copper, 1981 degrees; iron, 2786 degrees; lead, 621 degrees; manganese, 2246 degrees; nickel, 2646 degrees; tin 449 degrees, and zinc, 787 degrees Fahr.

It will be seen that copper and iron are elements which have the higher melting points of those commonly used as constituents in the compositions produced in the brass foundry. Consequently, where those elements are present in any appreciable quantity they have a major influence upon the melting point of the resulting alloy. Therefore, in general in the production of the nonferrous alloys for use in the foundry, the process of manufacture of these compositions is to first melt the copper and other high melting point elements, adding thereto the lower melting point elements, which begin immediately to dissolve in the bath of hotter metal. This is a general principle but the production of each of the individual compositions has been discussed in previous articles by the author.

In Table I, compositions *A* to *C*, inclusive, generally are known as leaded red brasses and are more or less derivatives of the standard alloy 85-5-5-5. The 85-5-5-5 alloy is known as ounce metal because it contains approximately one ounce each of the tin, lead and zinc to one pound of copper. It is also known as composition brass, although more familiarly known by foundrymen as eighty-five and three fives. This alloy is used commonly for a wide variety of purposes. Outstanding use of this alloy is in the production of valves and fittings, valve bodies where the pressures do not exceed 350 pounds per square inch, in centrifugal pumps, and while it is not recognized as a bearing metal many cheap bearings are made of it.

Hard Composition Machines Readily

All three of the alloys tool readily but of course *B* and *C* have the highest tin content, are the hardest, and consequently show the greatest difficulty in machining. However, if a proper cutting oil is used these alloys may be machined with great rapidity and with a resulting high grade finish. To get the best results in these alloys and to be assured of the most satisfactory machining conditions the impurities should not be allowed to creep above the following maximum: Iron, 0.25 per cent; antimony, 0.15 per cent; sulphur, 0.08 per cent; arsenic, 0.10 per cent; aluminum, 0.05 per cent; silicon, 0.01 per cent, and phosphorus, 0.03 per cent.

It should be noted that the presence of either silicon or aluminum is extremely undesirable since the presence of either element will tend to cause leakage when

the castings are subjected to pressure. Arsenic also tends to cause porosity; (the source of arsenic usually is copper having a small percentage). Sulphur reduces the strength, and antimony tends to make the metal hot short. Phosphor-copper or phosphor-tin frequently is added to the alloy just before pouring to increase its fluidity. This practice should not be allowed to result in a marked increase of the phosphor content. Therefore, only a limited amount of these phosphorus compounds should be used if the best results are to be obtained.

Composition *D* is known commonly as a balanced alloy since all of the elements are in solid solution. It is generally known as steam or valve bronze and is so specified by both the A. S. T. M., and the Federal Specification board, with some minor variation, such as the substitution of 1 per cent copper by 1 per cent zinc so as to increase the zinc from 2 to 3 per cent. This is illustrated by alloy *SS* in this table. Alloy *D* is used largely in the production of steam valves for medium and low pressure, particularly radiator valves, of which a vast number are produced annually in this alloy.

Cast in Thin Sections

It also is used for higher pressure as long as the temperature is moderate. It is not a bearing metal since it does not contain enough tin to form the hard copper-tin bearing crystal. It casts readily and will follow an intricate outline in a mold resulting in a fine sharp, true to pattern casting. It has found ready use in oil pumps, carburetor parts and many such types of castings where resistance to leakage is one of the prime factors, and ease of casting thin walled casting is important.

It will be noted that compositions *E* to *L* compose a group of leaded red brasses with lower tin than the 85-5-5-5 and the variations therefrom. That series also carries a larger percentage of lead and zinc and in the one instance of composition *G*, 0.5 per cent nickel is present. Alloy *E* as specified is an ornamental bronze by the U. S. navy and is regularly cast in parts of this type. On account of the high lead content it machines readily and even is tooled readily by hand. Composition *F* is used commonly for general purpose castings that are not subject to strength requirements but must be somewhat resistant to corrosion and yet machine readily.

Produced from Scrap Metal

That alloy is also used where low pressure demands are made upon it. Compositions *G*, *H*, *I*, *J* and *K* are used widely where a red color is desired and at the same time a low cost may be secured by the use of secondary ingot or even scrap of more or less known compositions can be counted upon to produce alloys within these limits. Composition *L* is similar to composition *K* in its many characteristics but it lends itself to economical production as an alloy that can be made from scrap readily and since it has a little higher tin than composition *K*, it approaches more nearly being a bearing metal than does composition *K*.

Effects of impurities of these alloys is somewhat similar to those previously discussed for compositions *A*, *B* and *C*. However, since these alloys are not meeting such rigid demands and frequently are made from scrap, impurities such as iron or antimony do creep in, but they should never be allowed to exceed the maximum of 0.25 per cent for iron and 0.15 per cent for antimony. If these alloys are to be used for pressure work, the aluminum and silicon contents must be kept rigidly at the minimum if best results are to be secured.

If a bright finish is expected of the castings, as commonly required for valve bodies, the sulphur content must be kept below 0.08 per (*Please turn to page* 76)

Table I

Compositions of and Other Data on Nonferrous Alloys

No.	Copper	Tin	Lead	Zinc	Manganese	Iron	Phosphorus	Aluminum	Pouring temp. degrees F.	Melting point degrees F.	Specifications A.S.T.M.	S.A.E.	FED.
A	91	2	3	4					1950-2300	1680-1820			
B	85	5	5	5					1950-2300	1680-1820	B-62-36	40	B691-(2)
C	88	5	2	5					1950-2300	1680-1820			
D	90	6.5	1.5	2					1950-2300	1680-1820	B-61-28		QQB691
E	81.5	2.5	10	6					1950-2300	1650-1800			
F	83	4	6	7					1950-2300	1650-1800	B-30-36 (8)		
G*	77	2.5	10	10					1950-2300	1650-1800			
H	77	3	10	10					1950-2300	1650-1800			
I	80	3	7	9.5					1950-2300	1650-1800	B-30-36 (9)		QQB70 (4)
J	84	3	3	10					1950-2300	1650-1800	B-30-36 (7)		
K	78.5	3	5	13.5					1950-2300	1650-1800	B-30-36 (10)		
L	80	4.5	2.5	13					1950-2300	1650-1800			
M	80	..	.....	20					1900-2100	1700-1840			
N	70	..	.....	30					1900-2100	1700-1840			
O	62.5	1	.....	36.5					1900-2100	1700-1840			QQB621-(a)
P	60	..	.....	40					1900-2100	1700-1840			
Q	83-86	..	max. 0.5	14-17	.....	0.15	max.		1950-2150	1870		44	QQB601
R	48-52	..	max. 0.5	50	.....	0.10	max.		1900-2100	1600		45	
S	51.5	3.5	max. 0.5	45	.....	0.10	max.		1900-2100	1600			
T	78	4	3	15					1900-2100	1700-1840			
U	75	2	5	18					1900-2100	1700-1840			
V	71	2	3	24					1900-2100	1700-1840	B-30-36 (11)		
W	70	1	2	27					1900-2100	1700-1840			
X	67	1	3	29					1900-2100	1700-1840	B-65-28		
Y	64	1	2	33					1900-2100	1700-1840	B-30-36 (13)	41	QQB621
Z	64.5	1	2	32.5					1900-2100	1700-1840			
AA	63	..	2	35					1900-2100	1700-1840	B-65-28		
BB	63.75	..	...	23	3.75	2.75		6.75	1725-1900	1650-1700			
CC	58	0.65	..	39.50	0.35	1.0		.50	1725-1900	1650-1700	B-54-27	43	QQB726
DD	55-60	..	0.20	38-42	3.5 max.	0.40-2 max.		1.50 max.	1725-1900	1650-1700			QQB726

* Nickel—0.5 per cent.

Cracks in Chill Rolls Present Problems

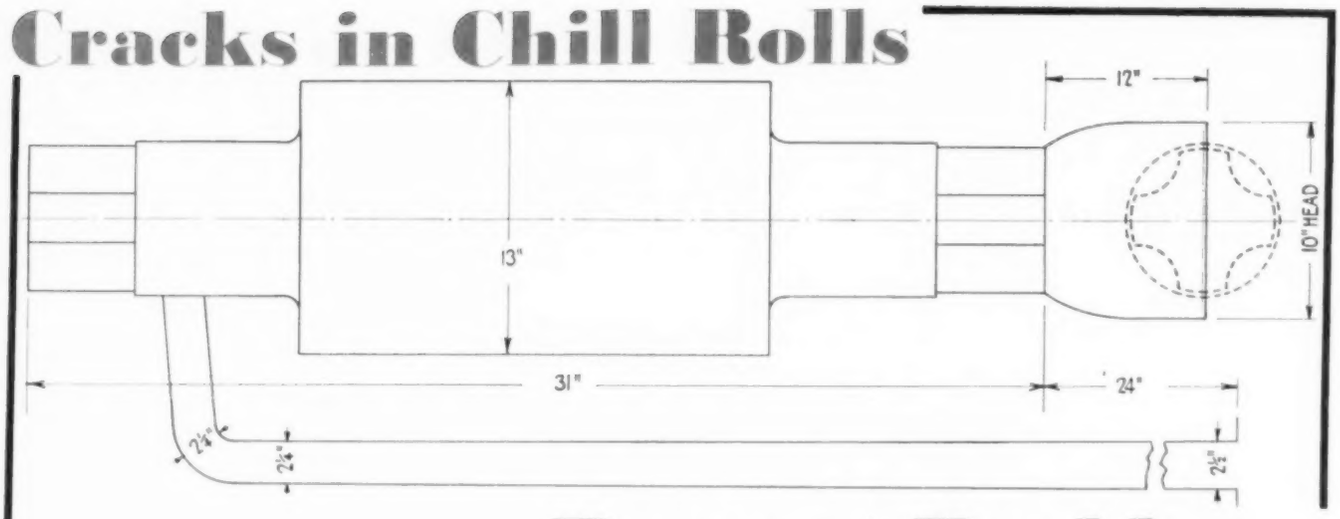


Fig. 1—Metal is poured into a long upright sprue and enters the bottom neck of the roll through a constricted gate set at a tangent

DISCUSSION on the probable cause of cracks in chilled rolls arose from receipt of the following inquiry from a foundry in India connected with an iron and steel plant: We make chilled rolls for our own use, 330 millimeters (13 inches) diameter and 800 millimeters (31 inches) in length. The majority of these castings show chill cracks either longitudinally throughout the entire length, or merely at the bottom. In other instances they crack circumferentially at different points including the neck. We have tried various experiments, but without finding a solution for the problem. Some of the rolls made under identical conditions do not show any defect.

Tried Chills with Grooves

The chills are from 6 to 7 inches in thickness, provided with four tapered grooves on the inside and are set up in a perfectly vertical position. We have tried a tangential gate at the bottom, and a central gate at the top. We have varied the size of the sprue from 1 to 2½ inches diameter. We have poured the metal hot and have poured it cold. A charcoal iron mixture shows the following analysis: Silicon 0.80 to 0.90 per cent; manganese 0.40 to 0.80 per cent; chromium 0.40 to 0.50 per cent; nickel 1.00 to 1.20 per cent; total carbon from 3.00 to 3.20 per cent. Alloy additions are made in the cupola and also at the spout.

Cracks also appeared when we tried a mixture of ordinary iron and steel scrap showing an analysis of: Silicon 0.70 to 0.90 per cent; manganese 0.90 to 1.10 per cent; total carbon 2.90 to 3.20 per cent. We have tried removing the chills from the rolls at various time intervals ranging from 25 minutes to as high as 60 hours. So far none of our experiments has shown a solution for the problem, especially where the rolls were chilled to a depth of 2 to 2½ inches.

In a long distance diagnosis based merely on the foregoing presentation and without any of the revealing touches usually brought to light in actual examination or in personal conversation, four prominent foundrymen who may be designated as A, B, C and D, presented views on the subject.

According to *A*, the technique involved in the production of chilled rolls represents probably the highest development in the foundry industry. In addition to a high degree of metallurgical knowledge and experience, the art involves another factor, a variety of sixth sense, a form of empirical knowledge which up to the present has not been translated into definite terms. This merely is another way of saying that only a skilled roll maker actually present in the plant and familiar with all the conditions down to the apparently most trifling detail, could solve this particular problem.

Present practice and metal composition, as outlined in the inquiry, and with slight variation, conform to accepted standards. Therefore apparently some—at present—unknown factor or variable discoverable only to a skilled roll maker in position to check over all the details, is responsible for the chill cracks. One of the obvious reasons for cracks is the presence of fins at the upper and lower necks where the sand part of the mold joins the chill. These fins interfere with normal contraction and result in cracks in the casting.

Data Based on Experience

Several general features were touched upon by *B* who claimed that it might seem simple to control foundry operations by the aid of scientific instruments and methods so that the product at all times is near perfection. This is done to a large extent in many branches of the foundry where the difficulties are not particularly severe. In the production of certain lines of castings so many complications enter into the process that the causes have not been clearly and definitely traced. In these cases empirical rules have been worked out in the light of past experience. Scientific data are qualified and broadened by these

rules slowly developed over a period of many years.

This is the case in the manufacture of rolls where the problems mainly are of a metallurgical nature, with the molding process comparatively simple. Metallurgical difficulties are caused by the large compact mass of metal setting and causing shrinkage strains and segregation. In chilled rolls where the molten metal comes into contact with an iron chill it is difficult to secure a perfectly smooth surface on the roll and to chill the metal to a definite depth. In controlling these factors, temperature of melting and pouring enter into the problem probably to a greater extent than they do into any other line of castings. Correct temperature of furnace operation and for pouring the metal have been worked out on an empirical rather than on a scientific basis.

Chilled rolls are divided into two classifications depending on whether they are to be used in hot rolling or cold rolling. The majority of chilled iron hot rolls are cast from air furnace iron. Metal for a comparatively small number is melted in the acid open hearth furnace. Metal for chilled cold rolls is melted in the air furnace and also in the cupola. Chilled rolls for hot rolling present the greatest difficulties of any class of rolls. One of the essentials distinguishing them from the chilled cold rolls and the sand cast rolls is the necessity for comparatively low sulphur content, usually kept below 0.08 per cent, but seldom below 0.05 per cent. This is one of the factors which preclude the use of the cupola for melting the iron for these rolls. Danger of picking up an excessive amount of sulphur from the coke is too great. Sulphur in large amount is objectionable in chilled hot rolls because of the prevalent tendency to cause cracks in the roll when it is in operation.

Manganese is kept between 0.20 and 0.30 per cent. In greater percentage this element tends to produce a sharp line with little mottle between the chilled and the gray sections of the roll. Manganese also decreases the depth of chill. Some carbon is lost in melting. The roll maker generally tries to produce a chilled hot roll with carbon from 2.75 to 2.90 per cent. Lowering the carbon closes the grain of the iron, but at this particular stage does not produce excessive shrinkage.

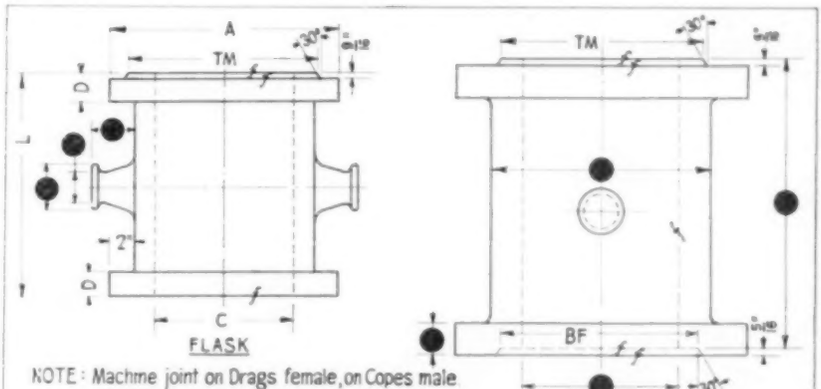
Composition of chilled hot rolls produced in the United States presents quite a contrast to those made in Sweden, where the manganese runs as high as 1.00 per cent and the total carbon ranges between 3.25 and 3.50 per cent. Phosphorus is kept extremely low, usually less than 0.05 per cent. An American roll maker would not attempt to cast a roll with such high manganese and carbon and certainly not with phosphorus as low as 0.05 per cent.

In the opinion of *C*, pouring temperature of the metal, temperature of the chills, character of the blacking and composition of the metal, any or all may be responsible for the cracks in the rolls. The metal should be no hotter than necessary to prevent appearance of pin holes on the surface of the casting. This point readily may be determined by experiment and observation.

Composition of the blacking applied to the face of the chills and the temperature of the chills when this blacking is applied constitute an important factor in the prevention of cracks. Certain foundry supply houses in the United States manufacture a special and highly satisfactory blacking for this purpose. It is mixed with plain water without molasses or other binder and is applied with a spray gun while the chills are at a temperature between 250 and 300 degrees Fahr.

Analysis of the metal should be modified as follows: Silicon 0.65 to 0.75 per cent; sulphur 0.07 to 0.08 per cent; manganese 0.30 to 0.35 per cent; phosphorus 0.45 to 0.50 per cent; total carbon 3.00 to 3.20 per cent. No alloys are added to this mixture made up of 50 per cent charcoal pig iron and 50 per cent chilled roll scrap. If necessary further sulphur is added to the metal in the ladle to secure desired depth of chill.

A chilled roll of the dimensions given and with a very deep chill has a tendency to break, irrespective of the composition, or of the manner in which it is molded and poured. In many cases a grain roll may be substituted for a chilled roll with beneficial results. This type of (*Please turn to page* 78)



NO. OF FLASK	A	C	D	DRAG L	COPE L	CORE L	TRUNION CORE BOX NO.	MALE TM	MALE BF	FEMALE
1	19"	11½"	2"	18"	17"	20"		16⅝"	16⅝"	
2	25¼"	18"	2½"	22"	26"			19⅝"	19⅝"	
3	34½"	20¼"	2½"	30"	30"			27⅝"	27⅝"	
4	41"	28"	2⅝"	30"	30"			36"	36¼"	
4	45"	28"	2⅝"	30"	30"			36"	36¼"	
5	52⅜"	32"	2½"	35"	35"			43⅜"	43⅜"	

Fig. 2—General features of flask and chill, also list of standard dimensions for various size rolls. Flasks are machined on joint ends. Chills are machined on both ends

QUESTIONS and ANSWERS

Desires Cupola Mixture for Making Stove Castings

We are seeking information on foundry practice in stove shops, particularly on the mixing of the iron.

Main requirements of stove plate iron are softness and great fluidity. Mixtures may be made up in various combinations to meet the following analysis: Silicon 2.25 to 2.50 per cent; manganese 0.50 to 0.60 per cent; sulphur 0.06 to 0.08 per cent; phosphorus 0.80 to 1.00 per cent; total carbon 3.50 to 3.75 per cent. The higher silicon, phosphorus and carbon figures are for light castings. The lower silicon, carbon and phosphorus figures are for castings of medium thickness.

State of the market, source of supply, location of the plant and in some instances certain local conditions are the principal governing factors in selecting component parts of the cupola charge. In many plants the charge is made up of 30 per cent northern foundry pig iron, 30 per cent southern pig iron and 40 per cent shop scrap with enough silvery pig iron or ferrosilicon to bring the mixture up to the required silicon content. The northern iron supplies the high carbon. The southern iron supplies the high phosphorus.

Nonferrous Casting To Resist Pressure Must Be Dense

What nonferrous metal mixture would you recommend to withstand a 1500 pounds per square inch oil pressure, and what is the greater pressure—water, oil, gas or steam?

Nonferrous castings which must resist high pressures should be made from an alloy that possesses a satisfactory tensile strength, and a good dense structure. Also it is necessary to see that gates and risers are such as to insure a well fed casting. One of the old favorite alloys for pressure castings is that containing 88 per cent copper, 10 per cent tin and 2 per cent zinc which is known as "G" metal, gun metal or admiralty bronze. A variation of that alloy is to substitute 5 per cent nickel for a similar quantity of tin making the composition 88 per cent copper, 5 per cent tin, 5 per cent nickel and 2 per cent zinc.

Another modification of the first mentioned alloy is one containing 88 per cent copper, 8 per cent tin and 4 per cent zinc. Suitable proprietary alloys which in addition to ability to withstand pressure, possess excellent corrosion resistance are those containing around 95 per cent copper, 4 per cent silicon and 1 per cent manganese or iron. Aluminum bronze and manganese bronze also are good pressure resisting alloys.

Your reference to effect of pressures is not quite clear to us. However, it might be pointed out that oil, gasoline, etc. are more *searching* than water, and will tend to seep or sweat through the minutest openings in the casting structure. Steam under high pressure usually is accompanied by increased temperatures due to superheating, and consequently unless the alloy can withstand elevated temperature in addition to pressure, it will not serve satisfactorily.

Outlines Methods for Making Pearlitic Malleable Iron

We operate a malleable iron foundry in Italy, and it is our impression that pearlitic malleable cast iron is used commonly in America. Can you give us any detailed information on the structural, chemical and mechanical characteristics, its uses, methods of production, and the reason why it is produced instead of the usual, normal black heart malleable?

Pearlitic malleable iron may be defined as any material which starts out as white cast iron and subsequently is heat treated to produce graphitization, provided the graphitization purposely be terminated when sufficient combined carbon remains to affect significantly the properties of the product. The combined carbon usually is present as pearlite although it frequently may be present as sorbite or martensite or some other form of decomposition product of austenite.

In general pearlitic malleables may be classified into two major divisions: Those produced by interrupting graphitization before completion, and those produced by reheating completely graphitized alloys. The first division further may be subdivided into metal having a composition similar to malleable cast iron in which the retention of combined carbon is due to shortening of the annealing cycle, and metal to which various retarding elements have been added to secure retention of combined carbon even with extensive heat treatment. Retarding elements used include manganese from 0.5 to 1.0 per cent higher than in normal malleable, chro-

mium from 0.1 to 0.3 per cent, molybdenum from 0.1 to 0.5 per cent, vanadium, and copper.

Physical properties of pearlitic malleables vary over a wide range depending on composition, heat treatment, etc., and show tensile strengths from 50,000 to 120,000 pounds per square inch, elongations from 15 to 1 per cent, and brinell hardness numbers from 130 to 250. Due to the wide range in properties that can be secured pearlitic malleables have a large potential field of use, and at present are being used in crankshafts and connecting rods, bearing caps, clutch disks, brake drums, gears and housings, chain links and sprockets, elevator buckets, wrenches, vises, tractor treads, etc. For a much more detailed review of pearlitic malleable iron it is suggested that you secure a copy of "Symposium on Pearlitic Malleable Cast Iron" which may be obtained from the American Society for Testing Materials, 260 South Broad street, Philadelphia.

Wants Information on Method For Deoxidizing Monel

Can you give us any information on whether there is any way in which monel metal may be deoxidized?

Monel metal and nickel are deoxidized and desulphurized by addition of a small amount of metallic magnesium. Only stick magnesium should be used and it is introduced by plunging in well under the surface of the metal with iron tongs or some other suitable holder. Amount added is 1½ ounces per 100 pounds of metal. It is added just before pouring. The magnesium held under the surface is stirred for a few seconds to permit diffusion throughout the metal. If the magnesium burns on the surface no benefits are derived, and an additional amount should be added. After addition of the magnesium, the metal is ready to be poured. Pouring should be done as quickly as possible, but not so quickly as to prevent the escape of gases picked up during melting.

Bronze Pump Liner Contains Many Pits and Cracks

We are sending a section sawed from a bronze pump liner. You will note that it contains numerous fine cracks and pits after machining. It appears to be a melting condition which we have been unable to correct. We are using a revolving, tilting, oil-fired furnace. The air pressure is 2 pounds and the oil pressure 30 pounds. Results up to about a year ago were satisfactory. The oil is 24 to 26 gravity, fuel oil with a sulphur content of approximately 0.53 per cent.

Study of the specimen of the pump liner submitted for examination leads us to the opinion that your difficulty may be from a combination of troubles rather than from only one. There is no doubt in our mind that the most flagrant offender is improper melting in that the metal is severely gassed. Therefore, the first thing to look into is the furnace atmosphere. You do not state what procedures you have used to correct the trouble so we must proceed in the dark.

If you have laboratory supervision, it is suggested that you obtain a simple, inexpensive Orsat apparatus and take samples from the furnace atmosphere to determine the composition of the gases. Presence of carbon monoxide indicates a reducing atmosphere. Consequently, the oil and air valves on the burners should be adjusted until a neutral atmosphere is obtained, that is to say one containing no carbon monoxide and no oxygen.

If you cannot run gas analyses, it will have to be a case of cut and try. Adjust the oil and air valves so that you secure what is known as a sharp flame as opposed to a long flame. However, if the flame is too sharp you will produce an oxidizing atmosphere which also will cause trouble. Hence, you will have to experiment until you approach the neutral condition. Since that probably is not so easy to do, it is advisable to stay on the oxidizing side rather than the other way about.

While we cannot state definitely, it appears that you may be pouring your castings at too high a temperature. Try pouring at different temperatures, and then select the lowest one which gives good solid castings.

Has Difficulty in Obtaining Good Tin Coat on Iron

We are doing some tinning, and have difficulty in obtaining good coating on cast iron. We also do some re-tinning, and at times have difficulty in removing black specks on the metal on which muriatic acid seems to have no affect.

Unless proper care is taken in preparing the surface of cast iron for tinning, difficulty is encountered in obtaining a smooth, uniform coating. Since you do not state your method of procedure preliminary to the hot tinning, it is suggested that you compare your present practice with the following:

After careful sandblasting of the castings they are pickled in hydrochloric (muriatic) acid diluted with an equal volume of water. Then without rinsing, the castings are dried in an oven. If the castings are to be tinned immediately, the drying may be omitted. Just before tinning they are dipped in a weak pickling solution composed of one part of hydrochloric acid and 20 parts of water and then in the tinning flux. That flux, sometimes called killed spirits, is made by dissolving metallic zinc in hydrochloric acid until no further action takes place.

Rough tinning is carried out in a tin bath covered with a layer of zinc chloride and sal-ammoniac, and heated to 500 to 525 degrees Fahr. The finishing kettle is operated at 482 degrees Fahr., and is covered with a layer of beef tallow. After shaking to remove surplus tin, the castings are quenched in kerosene, washed in hot water, and dried in sawdust.

The black specks encountered in re-tinning may be some greasy or oily substance since they are not attacked by the muriatic acid. Therefore, it is suggested that before pickling the pieces, they be dipped in a strong alkali bath used hot to insure removal of any grease or oil. After that cleaning operation, rinse these castings in boiling hot water to insure removal of all alkali, and then proceed with the muriatic acid dip.

Flasks in the Yard May Not Warp

Runouts have been blamed on flasks allowed to stand out in the weather. Do you know of any preservative coating we might use to protect them? Would creosote serve the purpose?

Although a contributory cause in some cases, a warped flask is rather a lame excuse for a runout. In a properly made mold the sand joint will prevent a runout even if the joint of the flask is not perfect. Snap flask molds retain their contents without any flask. We know of no instance where flasks were or are coated with any material to prevent them from warping. If the flasks are stacked properly they will not warp to any extent. The weather is only one factor to be taken into consideration. If the flask is supported on only two or three corners, the weather assisted by gravity certainly will twist it out of shape.

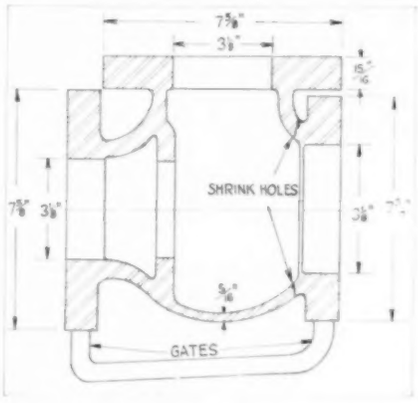
Shrink Holes Show In Steel Valve

We have had trouble with shrink holes between flange and body in a series of carbon steel valve bodies at the points marked in the accompanying drawing. The same pattern is used for making iron, steel and bronze castings and we are wondering if the design is responsible for the defect. We shall appreciate your opinion on this point, also on the correct molding practice.

The defect may be due to shrinkage, but it also may be due to any one or a combination of other causes. Lacking actual examination of the casting we hesitate to express a definite opinion. We are inclined to doubt the shrinkage theory, unless, of course, the feeding heads were not adequate to feed the casting properly. If that is the case the remedy is obvious. Increase the size of the heads until the shrinkage disappears. Design of the casting presents no abnormal features and therefore with a generous feeding riser on each flange, should not develop any shrunken areas.

You do not state whether the casting is made in a green or a dry sand mold. If made in green sand, the confined body of sand between the flange and the body may set up a slight commotion, unless it is vented properly. That commotion will be reflected in a spongy condition in the metal in the vicinity. A similar effect results from a core that is too hard, or is not sufficiently dried.

On this comparatively small casting the position of the gate is not a factor of major importance and will depend to some extent on the number of patterns in a flask. Probably the most convenient form of entry passage for the metal is a runner in the cope face of the mold



Defects may be the result of one or many causes

with a gate leading into two flanges as shown in the accompanying illustration. Shape and size of the gates do not constitute a factor of major importance provided the metal fills the mold in reasonable time to prevent cold shuts or other imperfections.

Shrinkage May Be Caused by Core

We are enclosing a blueprint of a cast iron cylinder weighing 175 pounds which develops an internal shrink between the ports. We make a larger size weighing 225 pounds with which we have no trouble. We have tried various methods of gating and have placed chills between the two port cores. We have tried heavy risers and pumping but without effect. Our charge of 2000 pounds in a 60-inch diameter cupola is made up of pig iron 1000 pounds, steel scrap 700 pounds and return scrap 300 pounds. Analysis of the pig iron shows: Silicon 2.46 per cent, sulphur 0.023 per cent, phosphorus 0.45 per cent, manganese 0.85 per cent.

Method of gating and composition of the iron are quite satisfactory in this particular instance. The casting might be gated according to any ordinary method without affecting the condition of the casting.

Basing our opinion on the data supplied we suspect the port cores as the cause of the trouble. The vent is not escaping freely through the proper channels. Either the core is too hard, or it is not vented properly. Surrounded by molten iron the core causes the metal to kick or boil in the vicinity with the formation of the resulting cavities or porous areas.

Presumably the mold is green sand. The mound of sand inside the flange may be a contributory cause in the development of gas which lodges in the iron. This mound also should be vented.

Increases Life of Annealing Boxes

Can you give us any information on a suitable composition for alloy cast iron annealing boxes which are approximately 24 inches long on each side. They are used for steel at a temperature of 1550 degrees Fahr. and placed in an oil fired furnace. At present we are using ordinary gray iron, but wish to make boxes that will stand up longer.

A number of alloy cast irons are available to withstand elevated temperature conditions. Those of course, with the highest alloy content will be more resistant than those with a lower content, and the selection will depend a number of factors including cost, service expected, etc. The high alloy irons will include those containing about 15 per cent or higher chromium, 1.50 to 2.00 per cent silicon and 2.85 to 3.75 per cent carbon. Another contains about 15 per cent nickel, 6 per cent copper, 2 per cent chromium, 1.50 per cent silicon, and 2.90 to 3.00 per cent carbon.

If you just want to increase the life of the annealing pots to a reasonable but well worthwhile degree, it is suggested that you try any of the following compositions containing for example 1.75 per cent nickel, 0.75 per cent chromium, 1.50 per cent silicon, and 3.20 per cent carbon, or one containing 0.60 per cent molybdenum, 0.70 per cent chromium, 2.65 per cent silicon, and 3.30 per cent carbon.

Color Yellow Brass By Dipping

Can you give us any information on coloring of yellow brass? We know there is some solution for accomplishing that purpose, but have been unable to find a description of it.

Several solutions are available for coloring or bright-dipping copper-base alloys. The one most generally used is composed of 2 gallons of sulphuric acid, 1½ gallons of nitric acid and 2 ounces of salt. The solution must be kept in a stoneware vessel, and in mixing, the sulphuric acid is poured slowly into the nitric acid with constant stirring. Considerable heat is generated during mixing, and the solution should be allowed to become almost cold before use. Also the solution is extremely corrosive and care should be taken to see that it does not con-

tact the skin as severe burns will result. Only a momentary dip or immersion is required. The castings are washed in cold water and then in hot.

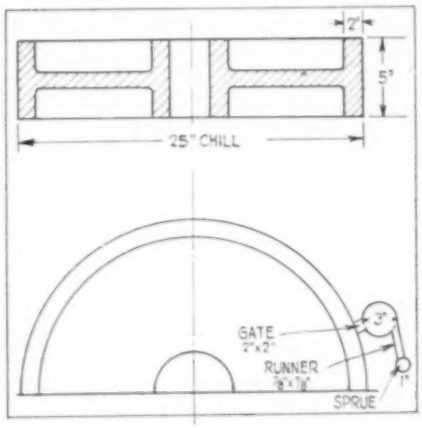
If the castings are to be lacquered to preserve the color, they should be dried after the hot rinse in hardwood sawdust. If the castings are not lacquered, the final hot water rinse should contain whale oil soap in the proportion of one ounce of soap to one gallon of water. When the castings dry, they are covered with a thin film of soap which prevents tarnishing to some extent. A fumeless dip which is said to give good results is composed of 10 pounds of sulphuric acid, 2 pounds of saltpeter and 5 pounds of water. The saltpeter is dissolved in the water, and the sulphuric acid added slowly with constant stirring as previously mentioned. Allow the solution to cool before using. Since it may be a trifle awkward to weigh out 10 pounds of sulphuric acid, a close approximation is to assume that a gallon of pure sulphuric acid, 66 degrees Baume, weighs about 15 pounds.

Dirt Shows in Rim Of Gear Blank

We are having trouble with dirt or slag in the face of a gray iron gear blank cast in a chill, 25 inches diameter, 5 inch face, web center and 2 inches thick in the rim. Analysis of the iron in the gear casting shows: Total carbon 3.20 per cent, graphitic carbon 2.45 per cent, silicon 1.50 per cent, manganese 0.70 per cent, phosphorus 0.20 per cent, sulphur 0.08 per cent. Diameter of the feeding riser is 3 inches, sprue 1 inch, runner between sprue and riser ¾-inch, and gate area 4 inches. We shall appreciate your opinion on this gating arrangement.

The arrangement of gate and riser on the casting defeats its own object, because the 1-inch sprue and small choke runner cannot possibly keep the metal up in the riser while it is flowing through the large gate into the mold. The idea is satisfactory in that the final metal in the riser is hot and fresh and therefore helps to feed the casting, but that feature does not outweigh the other essential viz: that the gate should prevent any foreign material from entering the mold.

If the casting is poured in a chill, as the drawing indicates, there is no necessity of placing a feeder on the rim. A much more satisfactory method of gating this casting would be through a number of small pencil gates on the hub. On account of the chill (kokille) the metal will have to be poured much faster than would be necessary in a sand mold. A dry sand core on top of the hub



Sprue and runner are too small to keep riser and dirt catcher filled with metal

with six ¾-inch pencil gates will serve satisfactorily.

Castings Must Be Hard and Tough

Can you give us any information on the best composition of cast iron for making stamp-mill shoes and seats for stone crushing in gold mining work? Also can you tell us how to determine the analysis of cupola coke? We would like to know the maximum sulphur that should be allowed in coke to give good results in melting.

We believe that the stamp-mill shoes and seats will give an excellent service life if made from a composition containing about 4.5 per cent nickel and 1.5 per cent chromium. The silicon content should be around 0.75 per cent, but of course will vary according to the section thickness. Cast against a chill, the brinell hardness will range from 600 to 700. To withstand the severe impacts in use, it may be well to subject the castings to a heat treatment which would consist in heating them slowly to 1600 to 1650 degrees Fahr., holding at that temperature 1 hour for every inch of thickness of the casting, and then cooling slowly in the furnace.

According to the American Society for Testing Materials, specification D 17-16 for foundry coke, the dry coke shall not exceed the following limits in chemical composition: Volatile matter, not over 2.0 per cent; fixed carbon, not under 86.0 per cent; ash, not over 12.0 per cent, and sulphur, not over 1.0 per cent. Since the complete description of the analytical procedure for analysis of coke is rather lengthy, it is suggested that you consult any well-known text book on analytical chemistry or obtain a copy of specification D 271-33 on standard methods of laboratory sampling and analysis of coal and coke which is available through the American Society for Testing Materials, 260 South Broad street, Philadelphia.

Has Trouble Due to Lead Segregation

We are experiencing trouble in making superheater packing metal for locomotives. We have tried to make it in green sand, dry sand, and in iron molds but without success. We have tried an alloy of 50 per cent copper, 50 per cent lead, but it proved too hard. The copper content then was reduced to 40 per cent and the lead increased to 60 per cent, but it still was too hard so the copper was reduced to 35 per cent and the lead content increased accordingly. However, we always find some lead at the bottom of the casting. Can you give us any information on a better packing metal, or suggest suitable procedure to obtain a satisfactory product from the mixtures previously mentioned?

Packing metal of 50 per cent copper, 50 per cent lead commonly is used and we know of several companies who manufacture it with satisfactory results. We feel that we are unable to put our finger definitely on your trouble except to say that if this 50 per cent lead, 50 per cent copper alloy is properly made it should be satisfactory and in all probability your trouble lies in your manufacturing process—probably in the melting department. It may be that you are gassing the alloy to some extent, or that the metal was poured too cold or too hot.

The metal should be melted rapidly and preferably in an oxidizing atmosphere. Some manufacturers of high lead alloys add copper oxide to the copper to help suspend the lead satisfactorily throughout the copper matrix. There are others who use a small fraction of a per cent of nickel in the copper to raise the temperature at which the copper solidifies so as to form a spongy mass promptly after pouring to enmesh the lead globules. Still others use special methods of their own, but we believe the most general practice is to use practically no addition to the alloy but to melt the copper rapidly and make sure to have an oxidizing atmosphere, and to avoid the presence of reducing agents on the copper, such as charcoal, etc. Just before pouring the metal stir it well so that no segregation occurs.

When the material is poured at the proper temperature and is cooled promptly in the mold, sound, clean castings are the result and their hardness has been accepted as being satisfactory by many users for the purpose described.

G. W. Hannay

Walter A. Janssen

E. E. Wright

Albert E. Rhoads

MEN of INDUSTRY

WALTER A. JANSSEN, chemical and metallurgical consulting engineer, Washington, has been appointed chief of the metals and minerals division, department of commerce, to succeed R. H. HARDING, Cleveland, who recently retired to enter private business. Mr. Janssen, born in Davenport, Iowa, graduated from the University of Wisconsin with a bachelor of science and chemical engineering degree. For 10 years he was general superintendent of the steel foundry division, Bettendorf Co., Davenport, Iowa. He was operating manager of Canadian Steel Foundries, Montreal, from 1917-1919; later, assistant vice president of American Steel Foundries. Mr. Janssen did consulting business in Pittsburgh as a chemical and metallurgical engineer and later became general manager for International Vanadium Corp., Moab, Utah. In 1919 he was vice president of the American Foundrymen's association and during the NRA was a deputy administrator in charge of the mining and quarrying division.

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G. W. HANNAY, recently elected president of the New Jersey Foundrymen's association, Newark, N. J., has been affiliated with the foundry industry for 14 years, the entire period having been spent with the Barnett Foundry & Machine Co., Irving, N. J. Mr. Hannay has been secretary and assistant treasurer to the Barnett company for the past 5 years. He became connected with the industry shortly after his graduation from the Wharton School of Business, University of Pennsylvania, Philadelphia. In his newly elected position, Mr. Hannay succeeds to the duties once held a number of years ago by his father, Gerald Hannay, who has long been active in the foundry industry and who for some years has been president and treasurer of the Barnett company.

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E. E. WRIGHT has been appointed Cleveland district manager for Electro Metallurgical Sales Corp., New York, with headquarters in the Union Commerce building, Cleveland. After graduating from Lehigh university, Bethlehem, Pa., in 1912, Mr. Wright entered the employ of Bethlehem Steel Co., Bethlehem. In 1918 he joined the electrode division of National Carbon Co., New York, transferring in 1937 to Electro Metallurgical Sales Corp. Both National Carbon Co. and Electro Metallurgical Sales Corp. are units of Union Carbide & Carbon Corp., New York.

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ALBERT E. RHOADS, recently appointed manager of the Detroit Electric Furnace division of the Kuhlman Electric Co., Bay City, Mich., was educated in the public schools of Harrisburg, Pa., and was graduated from Penn State college in 1915 as metallurgical engineer. Mr. Rhoads gained early practical experience in the foundry field while working as laborer, melter and laboratory assistant in foundries in the Niagara Falls district. From 1915 to 1916 he worked in the coke oven department of the Lackawanna Steel Co.'s benzol refining plant. In 1916 he joined the United States bureau of mines, Denver and Golden, Colo., where he worked on the extraction and refining of radium, uranium and vanadium, transferring to the bureau of mines at Ithaca, N. Y., in 1917 where, associating with Dr. H. W. Gillette, they did early experimental work on the rocking electric furnace. When the Detroit Electric Furnace Co. was organized in 1918, Mr. Rhoads first did installation, operation and service work for the company, later being transferred to selling. For the past several years he has been in charge of sales and service. He sold, installed and operated furnaces in England and France in 1933 and again in 1935. When Kuhlman Electric Co. took over the Detroit Electric Furnace Co., Mr. Rhoads was made manager of the furnace division. He is a member of the A. F. A., A. I. M. E., A. S. M. and S. A. E.

• • •

L. D. BRADY, Detroit, has been made foundry manager of the Spencer Heater division of the Lycoming Mfg. Co., Williamsport, Pa. Mr. Brady was connected for a number of years with the Rouge foundry of the Ford Motor Co., Dearborn, Mich. after which he spent 2½ years in France and 6 months in Italy. Returning to the United States he was general superintendent of Ferro Machine & Foundry Co., Cleveland, later connected with Kelsey-Hayes Wheel Co., Detroit.

CARL SCHAFFNER has resigned as foundry manager to become general plant manager, Hart & Crouse Co., New York.

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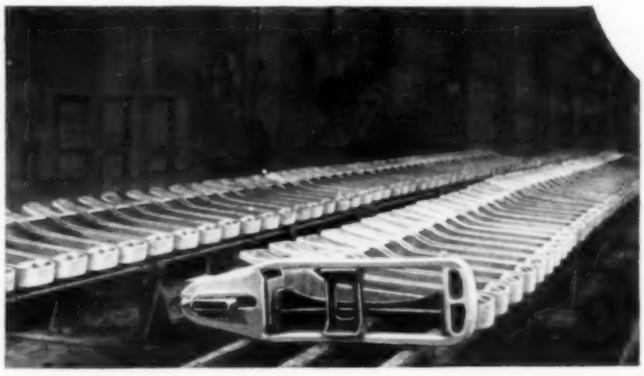
G. J. NASS, formerly superintendent, foundry division, Weber Engine Co., Kansas City, Mo., recently became general superintendent, Trinity Valley Iron & Steel Co., Fort

(*Continued on page* 42)

Chase those DEADHEAD TONS *with* CAST NICKEL STEELS

You chase free riders from your freights but are you stopping the most *flagrant* operating loss — the wasted cost of hauling millions of tons of useless deadweight in old type equipment? You can stop that needless loss by using modern Nickel cast steels for important rolling stock castings.

(Above) *A group of truck bolsters made of Nickel cast steel. Union Pacific officials, ordering new freight cars, saved 20-25% under casting weights by specifying Nickel cast steels in truck bolsters made by Buckeye Steel Castings Company.*



(Left) *5,200 light weight cast steel draft yokes were recently completed for the Union Pacific by Buckeye Steel Castings Company. This Columbus, Ohio, railroad foundry pioneered development of high-strength Nickel alloy cast steels. Nickel adds toughness, assures uniformity.*

BUCKEYE COMPOSITION (Average)

Carbon	0.28 %
Manganese	1.50 %
Nickel	1.40 %
Silicon	0.35 %
Phosphorus	0.030% max.
Sulphur	0.025% max.

PHYSICAL PROPERTIES

	Minimum Requirements	*Typical (1) Results*
Ultimate Tensile Strength	90,000 lbs./sq. in.	95,100 lbs./sq. in.
Yield Point	60,000 lbs./sq. in.	63,840 lbs./sq. in.
Elongation in 2"	22%	26.6%
Reduction of Area	45%	57.9%

STATIC TEST RESULTS

Bolsters:	Minimum allowable breaking load	423,500 lbs.
	Actual breaking load	509,200 lbs.
Yokes:	Minimum allowable breaking load	550,000 lbs.
	Actual breaking load	655,300 lbs.

(1) Heat Treatment: Normalize at 1600° F., air cooled and subsequent tempering at 1100° F. Typical results taken on test bars attached to castings.

THE INTERNATIONAL NICKEL COMPANY, INC., NEW YORK, N.Y.

(*Continued from page* 40)

Worth, Texas. Mr. Nass received his technical education at St. Benedicts college, Atchison, Kansas, and received his preliminary training in the gray iron and steel casting industry at the Locomotive Finished Material Co., Atchison, Kansas. At that plant he served in the capacities of chemist, melter, head melter and foundry foreman from December, 1924 to August, 1933. After leaving that firm he was employed by the Gwathmey Mfg. Co., Harrisonville, Mo., from August, 1933 to July, 1935 as metallurgist and foundry superintendent. At that time he became associated with the Weber Engine Co. as superintendent of its foundry division.

♦ ♦ ♦

WILLIAM S. SHIPMAN recently has become associated with the M. E. Wallace Co., Sunbury, Pa., in the capacity of chemist.

♦ ♦ ♦

MERRILL E. PRATT has been elected president of Continental Gin Co., Birmingham, Ala., succeeding ALGERNON L. SMITH, who has been elected vice chairman of the board.

♦ ♦ ♦

HARVEY L. RAMSAY has been appointed sales promotion manager, Porter-Cable Machine Co., Syracuse, N. Y. Mr. Ramsay for a number of years was sales manager of J. D. Wallace & Co., Chicago.

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R. H. MCGREDY, many years sales executive of Harnischfeger Corp., Milwaukee, has been appointed manager of the company's Washington office where he will be in charge of sales.

♦ ♦ ♦

WALTER C. RUECKEL has joined the staff of Battelle Memorial institute, Columbus, O., as research engineer. Mr. Rueckel, who has been with the Koppers Co. the past 3 years, will be engaged in ceramic research.

♦ ♦ ♦

FRANK P. SNYDER has been made sales representative of the Alexander Milburn Co., Baltimore, in the Detroit district. Mr. Snyder formerly was sales engineer for the De Vilbiss Co.

♦ ♦ ♦

H. N. CURD, vice president and manager, Pacific Car & Foundry Co., Seattle, recently was elected president of Federated Industries of Washington, succeeding E. I. GARRETT, president, Puget Sound Machinery Depot.

♦ ♦ ♦

J. M. FRANKLIN, former Birmingham foundryman, has been promoted to the managership of the Central Foundry Co.'s operations at Holt, Ala. Mr. Franklin graduated from Alabama Polytechnic institute, Auburn, Ala., and after serving in the World war, became associated with the Birmingham Pipe & Fittings Co. Later he became superintendent of Birmingham Machine & Foundry Co. and 12 years ago became assistant superintendent of Central Foundry at Holt. Mr. Franklin is a director of the Birmingham District chapter of the A. F. A.

♦ ♦ ♦

DR. GEORGE SACHS, prominent European authority on physical metallurgy, will join the faculty of Case School of Applied Science, Cleveland, in February, according to PROF. K. H. DONALDSON, head of the metallurgy department.

♦ ♦ ♦

HENRY M. REED, president, Standard Sanitary Mfg. Co., has been named successor to CLARENCE M. WOOLLEY as chairman and president, American Radiator & Standard Sanitary Corp., and as chairman of American Radiator Co.

♦ ♦ ♦

W. O. BATES JR., recently transferred from the San Leandro, Calif., offices of the Caterpillar Tractor Co., to become head of the patent department at Peoria, Ill., has been made a vice president of the company.

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G. W. KNOTTS, district manager, United Engineering & Foundry Co.; B. G. PARKER, president, Youngstown Foundry & Machine Co.; and A. J. WARDLE, president and treasurer, McKay Machine Co., were elected directors of the Youngstown chamber of commerce for 3-year terms.

♦ ♦ ♦

D. J. RICHARDS has been made manager of steel mill sales, E. F. Houghton & Co., Philadelphia. Mr. Richards will retain his headquarters in the Bessemer Building, Pittsburgh, where he has been a divisional sales manager for that company. He is a graduate of the University of Pittsburgh.

♦ ♦ ♦

WALTER B. STRONG has been made assistant general sales manager, Worthington Pump & Machinery Corp., Harrison, N. J. Mr. Strong is a graduate of Massachusetts Institute of Technology, Cambridge, Mass. of the class of 1917 and has been a member of the Worthington organization since 1920.

♦ ♦ ♦

WILLIAM B. COLEMAN, consulting chemist and metallurgist, has been appointed to the membership committee of Franklin institute, Philadelphia. Mr. Coleman is secretary-treasurer of the Metropolitan Philadelphia chapter of American Foundrymen's association, and a past president of American Society for Metals.

♦ ♦ ♦

J. M. MOORE, 1035 U. S. National Bank building, Denver, has been appointed representative of the Cleveland Quarries Co., Cleveland, for the sale of silica firestone and other products in Colorado. KLEIN-FARRIS Co., 610 Atlantic avenue, Boston, will represent the company in Maine, Vermont, New Hampshire, Massachusetts, Rhode Island and Connecticut.

♦ ♦ ♦

A. R. SOLTIS, in charge of sales of grinding wheels in the Detroit district for the United States Rubber Products Inc., also will represent that company in the Indianapolis and St. Louis districts. His headquarters will continue at Detroit.

♦ ♦ ♦

ROLLAND C. ALLEN, executive vice president, Oglebay, Norton & Co., Cleveland, has been made a member of the board of trustees, Battelle Memorial institute, Columbus. Mr. Allen will fill the vacancy created by the death of Joseph H. Frantz, late president of the board.

♦ ♦ ♦

F. K. VIALL, vice president in charge of research, Association of Manufacturers of Chilled Car Wheels, Chicago, was awarded first prize of $200 for his entry in an instrumentation contest sponsored by the industrial instruments section, Scientific Apparatus Makers of America. Mr. Viall's entry was, "An Automatic CO_2 Compensator for Cupola Control."

♦ ♦ ♦

C. E. HERINGTON has been appointed director of publicity and advertising manager, Meehanite Research Institute of America, Pittsburgh. He will conduct an advertising and publicity program for Meehanite metal. Mr. Herington previously was identified with M. K. Melott & Co., Pittsburgh, public relations counsellors.

♦ ♦ ♦

GUY C. BEISHLINE recently has been appointed district manager of American Car & Foundry Co., at Berwick, Pa. He succeeds WILLIAM S. JOHNSON who has retired after 53 years' service, Mr. Beishline began his career at the Berwick plant of the company, and after working there for several years, resigned in 1914 to join the Mt. Vernon Car & Mfg. Co., where he became plant manager, vice president and director. In 1937 Mr. Beishline rejoined American Car & Foundry Co. as special assistant on the staff of the vice president in charge of operations.

♦ ♦ ♦

ROY J. LECKRONE has been named chief designing engineer, Lewis Foundry & Machine division, Blaw-Knox Co., Pittsburgh. Mr. Leckrone has been identified with various fields of the steel and allied industries since leaving the Uni-

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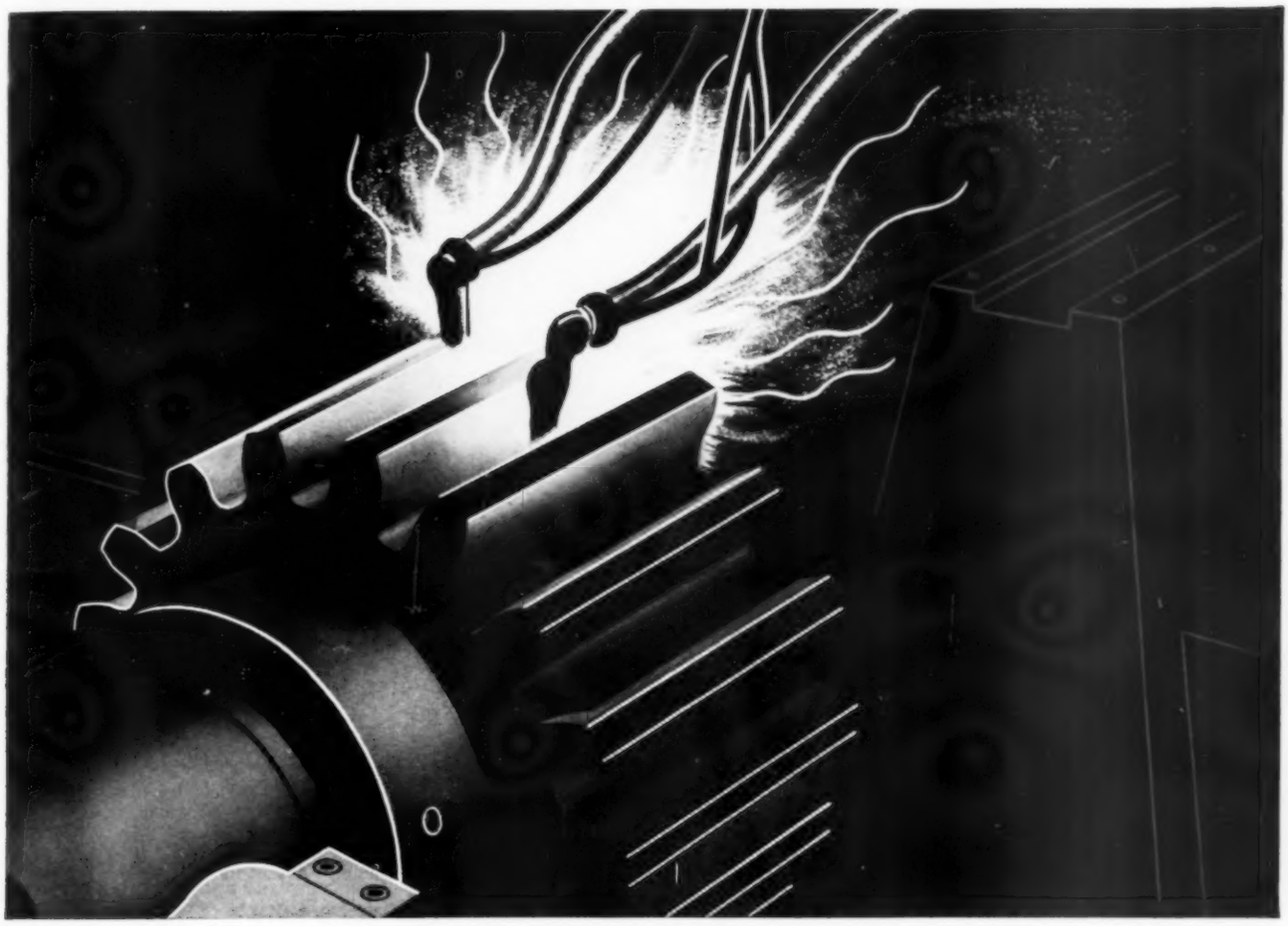


ECONOMY — WITH A MORAL

FLAME HARDENING of steel where exceptional wear resistant properties are required is a comparatively new process, but the economies resulting from its application in conjunction with Molybdenum steels, are most significant. They are graphic proof of the cash value of constantly re-studying your production processes and material specifications in the light of improved methods.

When high wear resistance plus good physical properties are required, flame hardening makes the use of relatively inexpensive alloy steels possible. Molybdenum steels, particularly SAE 4140, 4150 and high Carbon (0.40-0.50% C) Manganese Molybdenum, are exceptionally suited for flame hardening. They are practically fool-proof. Molybdenum (next to Carbon) is the most effective hardening agent normally added to steel.

Molybdenum steels and irons make production dollars go farther in many ways. Our technical books, "Molybdenum in Steel" and "Molybdenum in Cast Iron," will be gladly sent free to any interested production executive or engineer.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

Climax Mo-lyb-den-um Company
500 Fifth Avenue · New York City

MOLY

(*Concluded from page* 42)

versity of Pennsylvania. He spent 3 years in Russia designing and building American type rolling mill equipment. In his new position he will serve in both a sales and engineering capacity and will be located at the company's plant at Groveton, Pa.

• • •

DONALD B. GILLIES, vice president, Republic Steel Corp., Cleveland, recently was elected president, American Institute of Mining and Metallurgical Engineers, New York. The following directors were chosen for 1939: CHARLES CAMSELL, department of mines and resources, Dominion of Canada, Ottawa; CHESTER A. FULTON, Southern Phosphate Corp., Baltimore; JAMES T. MACKENZIE, chairman, iron and steel division, American Institute of Mining and Metallurgical Engineers, and American Cast Iron Pipe Co., Birmingham, Ala.; and FRANCIS A. THOMSON, chairman, mineral industry education division, A. I. M. E., and Montana School of Mines, Butte, Mont.

• • •

CHARLES T. RAY, president, B. F. Avery & Sons Co., Louisville, Ky., recently was elected president, Farm Equipment institute, Chicago. W. L. CLARK, vice president, J. I. Case Co., Racine, Wis., was elected chairman of the executive committee, other members of which are: W. D. JAMES, James Mfg. Co., Fort Atkinson, Wis.; C. B. SCHMIDT, DeLaval Separator Co., Chicago; H. S. LORD, French & Hecht Inc., Davenport, Iowa; W. A. Roberts, Allis-Chalmers Mfg. Co., Milwaukee; GEORGE S. HOOPER, Southern Plow Manufacturers' association, Chicago; and H. C. ANGSTER, National Association of Domestic and Farm Equipment and Allied Products Manufacturers, Chicago. F. H. CLAUSEN, president, Van Brunt Mfg. Co., Horicon, Wis., was elected first vice president of the institute.

Offers Course

Extension division, University of Wisconsin, Madison, Wis., is offering a home study course in composition of technical papers, available to individuals anywhere. The course is described as adapted especially to the requirements of workers in special fields who desire to increase their proficiency in writing business letters, reports and articles for publication. It presents in a few assignments the essential principles of English composition, introducing the student to an effective professional style, to the planning and arranging of technical papers, to the important points of paragraphing, punctuation, capitalization, abbreviation, proof reading and other phases of efficient writing in a specialized field.

Plan 1939 Convention Program

COMMITTEES of the American Foundrymen's association working on the program for the 1939 annual convention, to be held in Cincinnati May 15-18, report the program will be exceedingly interesting. The majority of the sessions will be held at the Gibson hotel where the registration headquarters will be located. Other sessions are to be scheduled for the Netherlands Plaza hotel.

Without the exhibition, a greater amount of time than usual is to be given to the technical and foundry practice sessions. Beginning with the opening session at 9:30 a. m., Monday, May 15, there are some 32 sessions tentatively scheduled for the week. These are designed to cover, through papers and committee reports, many of the more recent developments in the malleable, gray iron, nonferrous and steel casting branches of the industry.

For the steel castings division a special session on methods of melting is being arranged. This will be in the nature of a symposium on open hearth, electric and converter practices.

Under the general management classification are sessions on cost methods, foreman training, materials handling, safety and hygiene, apprentice training, and job evaluation and time study. At the cost session, methods used in the various branches of the industry to determine melting and molding costs will be compared with the material being presented in the form of a committee report. G. S. Stegemerten, superintendent, Time Study and Methods department, East Pittsburgh Works of the Westinghouse Electric & Mfg. Co., will be on the program of the job evaluation session.

New Features Arranged

A new feature planned for the convention is a four-session lecture course on the use of the microscope and elementary metallurgy. This will be given by Roy M. Allen, metallurgical consultant, Bloomfield, N. J., who will be remembered for his outstanding paper on the use of the microscope in the foundry, presented before the 1931 convention. This paper is being revised and amplified in book form and will be used as the basis of the material for the course.

Another session, new to A. F. A. meetings, will be one on castability or fluidity testing and control. While a committee has been studying this subject for several years, this will be the first time that an entire session has been devoted to this work.

A gray iron foundry shop course is being developed by a committee under the chairmanship of P. T. Bancroft, Moline, Ill. Tentative plans indicate this will prove of even more interest than those of past years, which have proved so popular.

The annual dinner is scheduled for the evening of May 17, and the business meeting for May 16. Part of the time of the business meeting will be given over to an outstanding lecture which will be the second annual board of awards lecture, the first having been given last year by Charles P. Hook, president, American Rolling Mill Co.

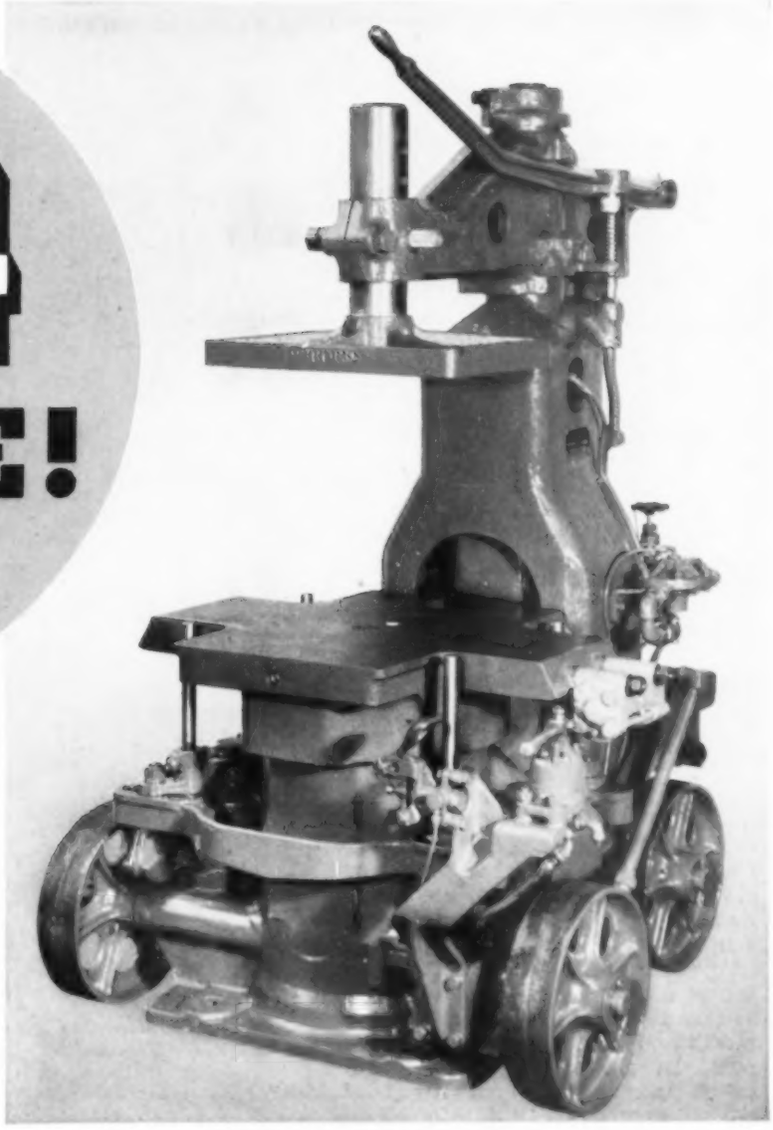
General interest technical sessions will cover pattern making, refractories and sand research. Each division is scheduling a round table luncheon meeting, where informal discussions of current foundry problems can be presented.

A committee of local foundrymen will plan a plant visitation program to the foundries and industrial plants of the Cincinnati territory.

Hear Discussion On Corrosion

Over 200 members and guests attended the meeting of the Cleveland District Committee of the A.S.T.M. held in Guild Hall, Cleveland, on Nov. 30, 1938. Following a dinner, Dr. F. N. Speller, National Tube Co., Pittsburgh, gave a talk on corrosion of iron and steel, and methods of prevention. His speech was confined to wrought products. Dr. Speller pointed out it is estimated that about one billion tons of steel and iron are in use which requires from 50 cents to one dollar a ton in protective maintenance. James H. Herron is chairman of the Cleveland District committee, and Arthur J. Tuscany is secretary.

7014 IS HERE!



NO. 7014 OSBORN JOLT SQUEEZE STRIPPER

covers a range of larger moulds

• Here is a larger, huskier Jolt Squeeze Stripper having all the advantages of the popular No. 7012 machine including Speed, Flexibility, Portability and Long Life.

The new No. 7014 has a 14-inch diameter Squeeze Cylinder with lifting pin centers and other parts in proportion.

Quickly adaptable to a wide scope of flask sizes in its respective range, each machine is engineered for fast, accurate production of high quality moulds.

Specifications and complete information about the new No. 7014 and the No. 7012 will be furnished promptly.

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TIME PROVES VALUES

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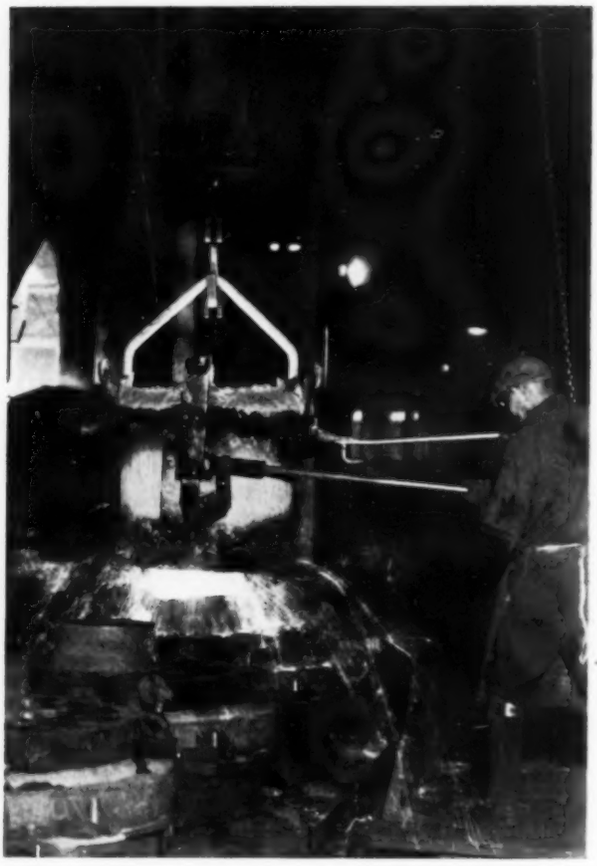
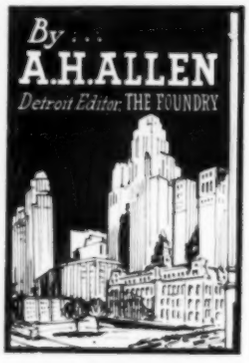
MOULDING MACHINES

Among Detroit Foundries



Pouring 750-pound chilled car wheels from 1800-pound transport ladle. Wheels are of the single-plate pattern, designed for freight cars of 100,000 pounds capacity. Griffin Wheel at Detroit currently is producing about 200 wheels daily—Courtesy Ira F. Cheney, Griffin Wheel Co., Detroit



MAJOR share of casting requirements for the car and truck output of Chrysler Corp. is supplied by the large six-story foundry operated by the Dodge division in the north central portion of the city. During periods of peak automobile production, as the present, this foundry takes the so-called cream of these requirements and the remainder is farmed out. In slack periods, Dodge is called upon to cast numerous small parts, in addition to cylinder blocks, transmission cases, clutch housings, brake drums and flywheels which now comprise 99 per cent of production.

Three cupolas supply iron with a fourth held in reserve when repairs are necessary to one of the others. One, with 102-inch shell, is operated 24 hours daily, two others with 92-inch shells are operated 16 hours. Daily output is running around 1050 tons in a plant originally designed for about 300 tons.

Three grades of iron are produced. The largest tonnage, cylinder block iron, averages about 35 per cent pig iron, 45 per cent baled steel scrap and 20 per cent miscellaneous returns in the cupola charge. Flywheel iron runs about 25 per cent pig iron and 45 per cent steel in the charge, while a third iron, used for small parts when in production, takes a charge of 40 per cent pig iron and 10 per cent steel scrap.

Two lines for cylinder block casting are operated in the "east" division. Iron is tapped from cupolas continuously into 1500-pound pouring ladles and conveyed by overhead monorail to the pouring lines where ladles are transferred to other monorail systems adjoining the line of molds. Iron is tapped at around 2800 degrees Fahr. and in approximately 2 minutes is being poured into molds.

Complete records are kept of pouring temperature and exact time of pouring for every cylinder block mold. These are correlated with brinell measurements made on every block and hourly chemical analyses of iron to provide a case history for every block poured. Daily sheets are filled out with these data and are filed for a period of 2 years, so that any subsequent trouble with engine blocks in the field can be traced back quickly to the time such blocks were poured and any iron peculiarities readily observed. One sheet carries pouring temperatures and time; a second brinell readings. On the temperature sheet any changes, such as the use of iron from a different cupola, are noted in red pencil, while on the hardness sheet, any blocks which fall below or exceed hardness limits of 184-217 brinell, set by the engineering department, also are marked in red. Soft blocks are scrapped. Hard ones are painted with yellow markings and either annealed or sent through to the machining department *special* so that condition will be known when machining is started.

Rather remarkable uniformity has been achieved in block hardness. Rejects are held under one per cent in a daily production which often runs as high as 3400 blocks. For example, on a recent day's run of 2200 Plymouth blocks, only 7 showed hard on the brinell sheet.

The plant supplies blocks for Plymouth, Dodge, De Soto and Chrysler 6 models. No 8-cylinder blocks are cast by Dodge.

In pouring cylinder blocks, horizontally two to a mold, a rather unusual device has been worked out to gage the amount of iron. Two small wires are placed in the cope, about 1-inch apart, and at a certain specified height. Ends of these wires protrude from the side of the mold and as it is about to be poured an electrical contact is plugged onto these wires. When exactly the right amount of iron has been admitted to the mold, including a sufficient supply in the sinkhead, contact is made between these wires by the molten metal and an electric horn near the ladle man is actuated. Immediately he knows he has

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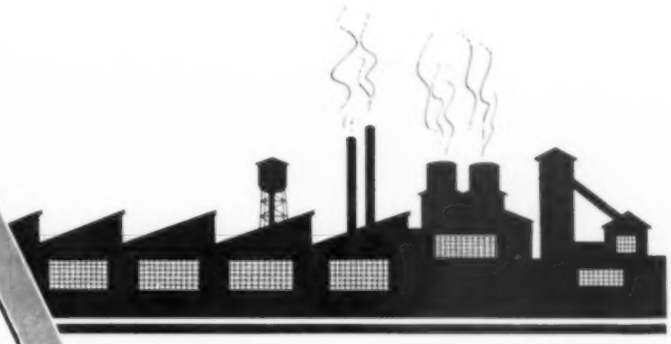
"WE CERTAINLY APPRECIATE THE FINE SERVICE OF YOUR METALLURGIST"



FOUNDRIES in many sections of the country have written us expressing their appreciation of the services of our metallurgist who is retained by Woodward for the sole purpose of assisting foundries in solution of their problems. Here is one that came recently to hand.

"Woodward Iron Company,
Woodward, Ala.

Gentlemen:

We are most appreciative of the fine service rendered us by your metallurgist. Sometimes, as you probably know, when an outside man comes into a foundry, he causes some suspicion or a little resentment or resistance. But I think I'm safe in saying that all of our foremen, as well as our moulders, were glad to have your metallurgist with us and trust he will be able to come up and spend several days at a time with us at frequent intervals. He has rendered us a very complete report and we are going over this in detail. Assuring you of our appreciation, we remain,

Yours very truly,"

If you, too, have a tough foundry problem on which you'd like the counsel of a well trained metallurgist who has had a wealth of practical experience and through schooling—get in touch with Woodward. Our metallurgist is at your service any time you call and without any obligation whatsoever.

WOODWARD IRON COMPANY
WOODWARD, ALABAMA

America's Largest Completely Integrated and Entirely Independent Merchant Iron Producer

(*Concluded from page 46*)

poured enough iron and tilts back the ladle. This arrangement has reduced the weight of scrap sinkheads from a former 45-50 pounds to a uniform 16 pounds which is just the right weight to insure a sound casting.

The molds are shaken out 20 minutes later and the red hot blocks hooked to an overhead conveyor, with the cores still in place. Cores are removed from Plymouth blocks about 3 hours after pouring; from De Soto blocks in about 2 hours. Replaced on a conveyor the blocks are carried through a straight-line steel shotblast booth and then on through the regular cleaning, grinding, chipping and water testing operations. Close control of cooling time is practiced to maintain uniformity in the blocks, as well as to bring about the proper balance between machinability and bore hardness.

Coreblowing, baking and washing operations are carried out on the second and third floors of the foundry, with melting, pouring, shakeout and cleaning all on the first floor, as well as molding machines for cylinder blocks. Barrel and crankcase cores are blown horizontally, with two twisted rods in each barrel for support. After baking, these cores are conveyed automatically through a core wash station in which the tank holding the solution is raised so that the cores are submerged. Heat retained from baking is sufficient to dry the core wash. Cores are placed in conveyor baskets at an angle of 10 to 15 degrees from the vertical so that excess core wash will drain off properly.

Drags for cylinder block molds are rammed on a turntable station synchronized with an adjacent conveyor line. Drags are sprayed with a mixture of plumbago and water and are skin dried under a battery of ten swinging high-pressure gas burners. As the molds pass under these burners they strike levers at the side which kick-on and kick-off the gas burners so that the high-pressure flame is on only while the mold is passing beneath it. The burners are mounted vertically in a gang and swing slowly through an arc of about 45 degrees.

Copes are sprayed with a mixture of 3 quarts of plumbago and 1 quart of clear lacquer to 5 gallons of alcohol.

Flywheels, clutch housings, transmission cases and brake drums are made in the west division. Daily production occasionally runs as high as 5200 units on some of these parts. Two flywheels are cast in each mold; two clutch housings per mold, and four transmission cases per mold. After pouring, these molds travel down lengthy conveyor lines, entirely hooded except at intervals, opened for breaking off heads, etc.

After shaking out, flywheels are tumbled with mill stars to clean them. Occasionally they may be routed through the shotblast equipment. A rotary shotblast also has been installed and is being used to clean clutch housings. Cleaning by blasting has been found to produce a considerably improved casting surface and naturally has bettered working conditions, and reduced noise over tumbling operations. No. 14 steel shot is used in this equipment.

An attempt is made to condition the air in the entire foundry wherever smoke, dust and grit are encountered. A system of regularly spaced vents draws in all foul air and pulls it to two outside dust catchers, one the dry type and the second the wet type. Sludge from the latter is pumped to two dewatering rotoscoops where it is partially filtered, and then to settling tanks where the remaining silt settles. Solid material from the dewatering equipment is transferred to a conveyor belt which carries it to gondola cars below.

Business Volume Depressed

Steel foundries in this area have been faced with a depressed volume of business this year, railroad buying particularly being sharply restricted. About the only activity has been in the equipment needs of automobile plants, and these have not been heavy. As a consequence, some steel foundries have turned their attention to other fields, seeking to develop new lines of business to supplant customary tonnage.

Illustrative of this trend is the activity which Detroit Steel Casting Co. has undertaken in developing new steels for tools and dies. After several years of research two new types of cast steel of the low-alloy type have been evolved and are just now coming into fairly broad commercial acceptance in die applications.

One is known as the E-3 type, a low-alloy analysis containing 1 per cent copper, high manganese and about 0.30-0.35 per cent of carbon. This is a water-hardening type of steel and shows unusually small deformation in hardening and quenching. For example, recently a 3800-pound anvil cap for a large hammer was cast, heated and then quenched in cold water without cracking.

The second or E-4 type is a low-alloy type (total alloy content about 1.5 per cent) containing molybdenum, with carbon varied to suit needs. Chief feature of this cast steel is its ready susceptibility to flame hardening, high tensile strength, toughness and ductility. For example, it may be supplied as soft as 220 brinell, with tensile of 130,000 pounds per square inch; surfaces may be flame hardened quickly to as high as 630 brinell. The steel welds easily and is reputed to be filling a long-felt need in the body die field.

With E-4 steel, the die is machined and spotted in the press in the soft condition; then a torch is passed over those sections where hardness and resistance to wear are most important and the desired qualities thus are achieved within the die itself, saving many hours of labor and more than offsetting the slightly higher cost of the die steel.

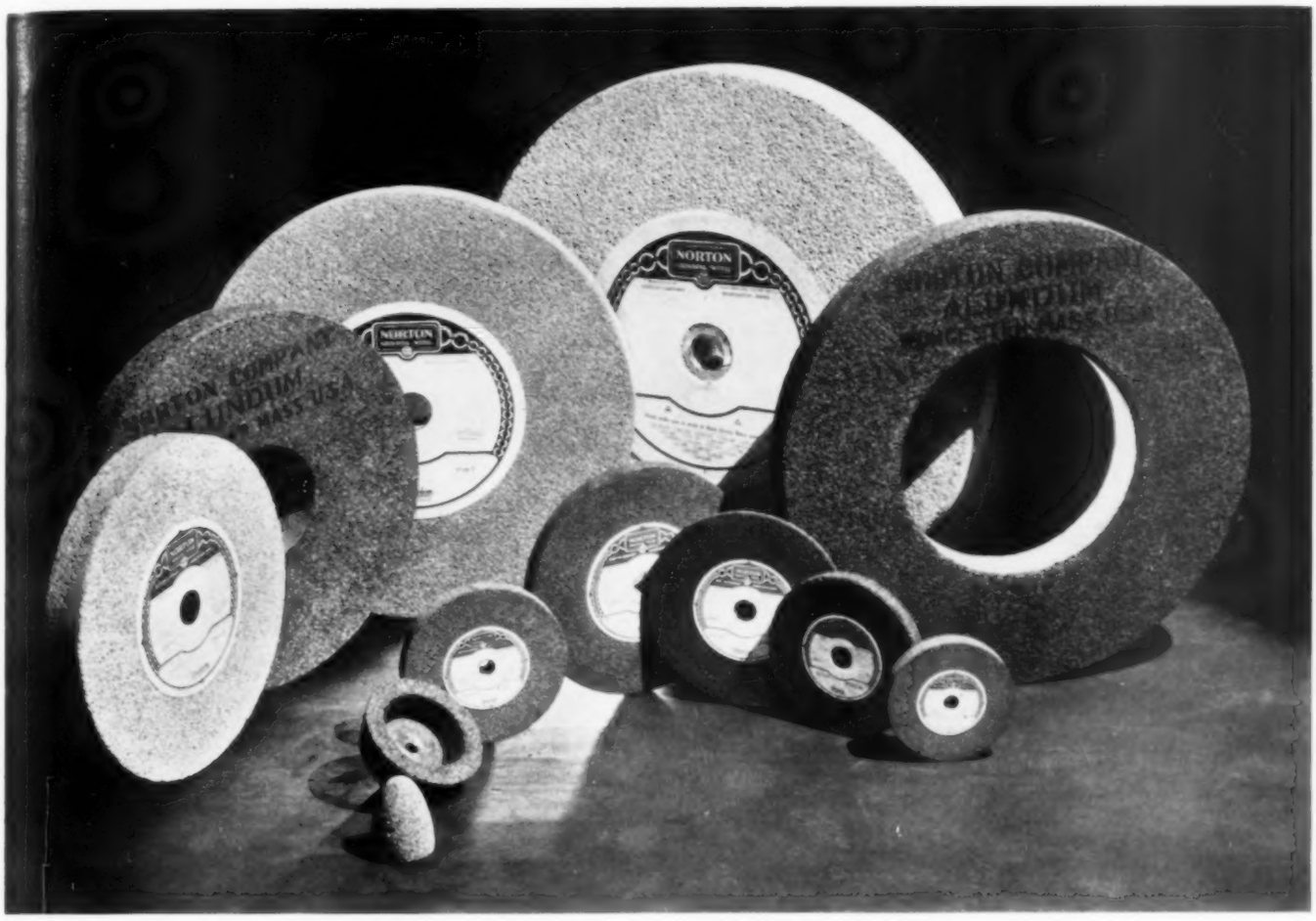
Further, when engineering changes are required in a large die of this type hardened areas in the steel die can be softened by heating below the change point (about 1550 degrees Fahr.), making the required changes and then flame hardening again. Thus the die need not be scrapped to accommodate design changes. Beads can be built up or pieces added by welding, and the surfaces may be hardened or softened practically at will.

New applications for this versatile die material are being suggested rapidly in plants using the material. The producer of the steel is hard pressed to keep abreast of these new possibilities. Several car manufacturers are using this type of steel for body dies in 1939 models, more are running tests on the steel now. One plant is using the E-4 steel successfully in punches and grips for a hot flanging operation, and is finding the absence of scoring an advantage.

Tests are now being made in adapting the steels to use in hot forging dies and preliminary results are reported to be highly favorable. The attempt to persuade forging interests to use a *cast* steel in dies and tools has been likened to bearding a lion in his den, but there appear to be a number of inherent advantages which castings possess in dies for stamping and forging operations—advantages which perhaps have been underestimated in the past, but which alert foundrymen are prepared to make the most of now.

Light Core Boxes

Adaptability of magnesium alloys for use in core boxes is being pointed out by interests promoting the development of these alloys. Charles B. Bohn of Bohn Aluminum & Brass, speaking on this subject, has observed that a motor car manufacturer using this type of corebox has taken over 2,400,000 crankcase cores from a single box, all the more noteworthy when it is considered that these cores are blown under an air pressure of from 100 to 125 pounds. Furthermore, the light weight boxes reduce worker fatigue, and freedom from clinging means savings in time and energy, it is claimed.



There's a Wheel Here That Can Cut Your Cleaning Room Costs

WHETHER your castings are steel, gray iron or a non-ferrous metal, whether your machines are slow speed or high speed—you can be sure that there's a Norton Wheel that will take off most metal at lowest cost. There are Alundum, 15 Alundum and Crystolon abrasives; resinoid, rubber and the new B-E vitrified bonds; a wide range of grains, grades and structures in each abrasive and bond; and special treatments to reduce loading and improve cutting action. Let a Norton engineer select the right wheels for your jobs.

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NORTON ABRASIVES

Foundrymen Meet at Cornell

DESPITE inclement weather conditions and the state of the highways, 200 foundrymen attended the second regional foundry conference at Cornell university, Ithaca, N. Y., held under the joint sponsorship of the Buffalo Chapter, A.F.A., College of Engineering, Cornell university and the Syracuse (N. Y.) Foundrymen's association, Nov. 25 and 26.

The conference was arranged and conducted under the general chairmanship of Henry B. Hanley, foundry manager, American Laundry Machinery Co., Rochester. Buffalo Chapter A.F.A. was represented on the committee by Martin A. Pohlman, vice president Pohlman Foundry Co., Buffalo, and R. K. Glass, metallurgist, Republic Steel Co. H. H. Judson, foundry superintendent Gould's Pumps, Inc., Seneca Falls, N. Y., and J. H. Lonergan, Morris Machine Works, Baldwinsville, N. Y., represented the Syracuse Foundrymen's association. College of engineering, Cornell University was represented by Prof. A. C. Davis.

Although designed primarily to serve the interests of northwestern New York foundrymen, the conference attracted visitors from Illinois, Ohio, Pennsylvania and New Jersey. The conference was singularly fortunate in having as toastmaster at the banquet Marshall Post, president of the American Foundrymen's association and also by the presence of Hyman Bornstein, immediate past president of the association, who spoke briefly at the luncheon meeting Saturday.

All activities, technical sessions, registration, luncheons and dinner, and committee meetings centered in Willard Straight hall, one of the many handsome and imposing gray stone buildings on the campus placed at the disposal of the conference by the university. The closing feature of the conference, a demonstration of physical testing apparatus and a demonstration of metal crystallization by Dr. C. W. Mason, chemistry department, Cornell university, was presented in Sibley hall.

Technical sessions were confined almost exclusively to ferrous foundry practice, gray iron, malleable iron and steel with specific papers on malleable iron short cycle anneal, gates and risers, cupola practice, manufacture of steel castings, sand control problems and elementary metallurgy. Dust hazards in the foundry were discussed by Dr. Leonard Greenburg, executive director division of industrial hy-

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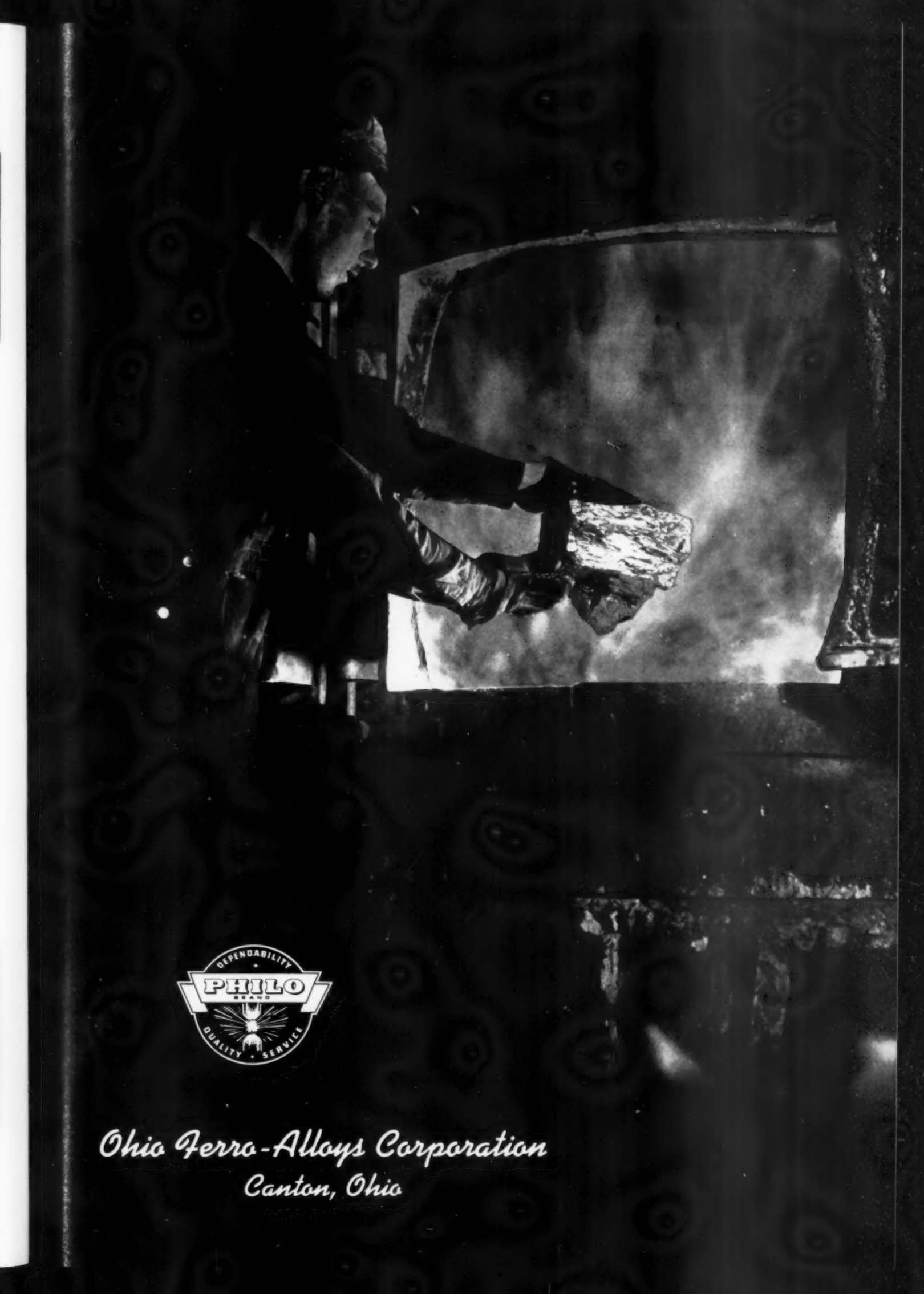


Ohio Ferro-Alloys Corporation

Canton, Ohio

(*Continued from page* 50)

giene, state department of labor, New York, and by E. O. Jones, director of safety and hygiene American Foundrymen's association, Chicago.

An extremely interesting address on ancient bronzes was presented by Dexter S. Kimball, dean emeritus, college of engineering, Cornell university following the luncheon on Friday. The featured address at the dinner "Some Practical Ideas About Industrial Relations" was presented by J. A. Voss, director of industrial relations, Republic Steel Corp., Cleveland. Orchestral and vocal music at the dinner was supplied through the courtesy of VanLoan Whitehead, Jr., Whitehead Bros., Buffalo.

Presented Malleable Paper

Following the opening of the first session by Robert E. Kennedy, secretary of the A.F.A., and an address of welcome by Dean S. C. Hollister, college of engineering, Cornell university, the chair was taken by Ralph T. Rycroft, vice president, Jewell Alloy & Malleable Co., Buffalo, who introduced W. J. Diederichs, metallurgist, Autocar Co., Ardmore, Pa. In presenting a paper on malleable iron Mr. Diederichs referred briefly to a paper on the same subject prepared by the late Joseph B. Deisher and presented at a similar conference last year, which touched on historical features, product and equipment, development and improvement and finally touching upon the more recent trends in the industry, short anneal cycles and pearlitic malleable.

Mr. Diederichs stated that a brief discussion of graphitization should prove of interest for it clarifies results obtained in standard practice. The more recent trends have resulted from extensive study of the graphitization process and application to practice of the information so developed. He stated that this presentation was not to be taken as a complete review of the subject, merely an endeavor to indicate some of the principles involved without being more technical than necessary, in other words a general picture.

Beginning with a discussion of steel he stated that structural make-up and changes involved when subjected to heating and cooling cycles have been the subject of long research and in general our knowledge of this subject is quite precise and complete. Discussing the fundamentals he pointed out that metals are crystalline materials or crystalline aggregates. Metals are arranged in definite geometric pattern. Some of the metallic elements form in more than one arrangement, depending on conditions. Different arrangements produce different physical and chemical properties. Up to 1670 degrees Fahr., iron has one arrangement. Above 1670 degrees the atomic arrangement changes. Up to 1670 degrees iron will not take carbon into solution. Above that point it absorbs various amounts depending on time and other factors. At this point and at several other places the speaker illustrated his remarks with diagrams on the blackboard.

The entire malleable iron industry, also gray iron, he claimed, is based on the fact that iron carbide is not stable. In the cast irons it breaks down into its constituents, iron and carbon or graphite. Silicon seems to make carbon more unstable. It also raises the temperature and speeds chemical action at higher temperatures. The speaker described the structure of white iron and what happens when it is heated to between 1600 and 1700 degrees Fahr. — first stage anneal to equilibrium. This was followed by a description of the second stage and an outline of the standard 7 to 9-day anneal. Further description covered several features including too short a period in the first stage, cooling too quickly, proper time at all stages, formation of bullseyes and pearlite, effect of holding below critical range as a corrective.

Raise Carbon and Silicon

In the latest trend toward short cycle annealing time certain foundries are leaving former standard analyses and are raising the carbon and silicon content. Instead of the usual combined 3.20 to 3.40 per cent, one is running as high as 3.90 per cent (2.70 carbon and 1.20 silicon). Another in light castings is reported going to silicon 1.60 to 1.90 per cent and carbon 2.00 to 2.40 per cent. Complete graphitization is reported in about 15 hours.

Willard Rother, metallurgist, Buffalo Foundry & Machine Co. served as chairman while Pat Dwyer, engineering editor, THE FOUNDRY, Cleveland discussed gates and risers principally from the view point of the part they play in the production of defective castings. Fundamentally he claimed the production of castings is a simple process well within the capability of any ordinarily intelligent person. A pattern is placed in a simple container of wood or metal or in a hole in the floor. It is surrounded with packed sand, then withdrawn and the resulting cavity is filled with molten metal which upon solidifying assumes the shape of the pattern. Apparently nothing could be more simple, and yet as a matter of fact as all foundrymen are aware, the successful production of castings represents highly specialized effort. A multiplicity of detail is involved and many factors must be considered. Unless every detail is carried out faithfully and unless every factor synchronizes and coordinates with the others in orderly sequence, the casting will not serve the purpose for which it was intended. Development of this theme afforded the speaker the opportunity to inject occasional touches of the wit and humor which have characterized his writings in THE FOUNDRY for many years.

Elliott Armstrong, Inter-Allied Foundries of New York State, Buffalo served as chairman at the session devoted to a consideration of dust hazards in the foundry as discussed by Dr. Leonard Greenburg, and E. O. Jones. Dr. Greenburg based his address on a statistical survey of 80 foundries of various kinds in New York state and the conclusions drawn from an analytical study of these figures. However, further study is in progress and will be completed before final results are available for publication.

Reduce Dust Hazards

Following a general introduction on the subject of dust and its suppression, E. O. Jones instanced the practice in several plants where intelligent cognizance is taken of inherent dust hazards, and the means adopted to reduce these hazards to a minimum. In one plant a man walks through the plant every day armed with a large salt shaker filled with a particularly offensive smelling powder. He sprinkles a little of this material at any point that does not conform to the general good housekeeping policy of the plant. In another plant a contest is held every month. The foreman with the highest rating on the good housekeeping program receives a box of cigars and — perhaps more important as a measure of keeping him up on his toes — his wife receives a 5-pound box of candy. The open house program staged once a year by several progressive firms has proved a powerful incentive in keeping the plant spick and span. In several instances a series of candid camera studies of areas before and after a general cleaning program have proved highly efficacious.

Cupola practice was discussed by Donald J. Reese, International Nickel Co., Inc., New York, at a session presided over by Martin W. Pohlman. By way of introduction the speaker presented his broad definition of the complete melting process and then discussed the cupola as a long time investment. A cupola operating under ordinary conditions and with the initial expense amortized over a period of 20 years represents an extremely

(*Concluded on page* 55)

(*Continued from page* 52)

small outlay. On the subject of cupola operation he claimed that one of the most important factors is the amount of the bed charge of coke. He stressed the advisability of using the smallest size cupola consistent with production demands.

Mr. Reese presented a detailed discussion of fuel burning rates, melting rates, normal operating conditions, wind pressure requirements, coke charges and metal charges, illustrated by formulas and examples. He described the method required to melt hot iron and how to use steel and limestone. The second section of his paper was devoted to factors in determining the requirements of the measurements of a cupola and parts, tuyere sizes and performance, types of blowers, gages and metering devices. The concluding section dealt with control of moisture in the blast, preheated air and other factors related to temperature of iron at the spout and from the ladle.

Viewed from New Standpoint

Speaking at the conference dinner, J. A. Voss directed attention to the fact that this nation has seen a remarkable industrial development during the past half century and as a result practically everything has to be viewed from a new standpoint. With all these advances he claimed we still have one vital problem which must be solved if industry is to make further progress, and that problem is the relationship between employer and employe, with the general public a vitally interested third party. Executives of large business enterprises today lack the personal contact with employes which prevailed in former days, hence the necessity of having a duly qualified person whose duty it shall be to learn what is on the worker's mind and present his findings to the management .This man should be perfectly unbiased, which is not always the case with foremen and superintendents who conceivably might hesitate to report conditions which reflect on their managerial ability. The speaker entered into considerable detail on the qualifications required for a job of this kind.

Touching on a recent visit to England he stated that the feature of most interest to the American employer and employe in the British system of labor relations is that it is the express desire of both men and management to keep their negotiations and discussions as free as possible from government interference. In England the government remains entirely free of labor negotiations except in the event of serious emergencies. Interference and intrusion on the part of our government in the opinion of the speaker have complicated collective bargaining in this country. In conclusion he discussed the Wagner act and its enforcing agency the National Labor Relations board and directed attention to many features which actually defeat the allegedly original intention.

K. V. Wheeler, Lebanon Steel Foundry, Lebanon, Pa., presented an interesting paper on steel castings at the opening session Saturday, presided over by T. H. Burke, Otis Elevator Co., Buffalo. According to the speaker the art of producing steel castings has been developed to a high plane in recent years. Castings are made today that were entirely outside the scope of practical accomplishment 25 or 30 years ago. Alloying, melting, molding, coremaking, heat treating technique has advanced to meet the most severe specifications. Designing engineers working in harmony with the foundrymen are willing in the majority of instances to modify design if necessary to meet foundry requirements.

The speaker showed a number of slides to illustrate problems encountered in the production of steel castings and the measures adopted to solve these problems. In conclusion he exhibited several examples of welding in proof of his contention that modern welding is a legitimate tool. Properly made welds do not detract from the value of a casting.

Present Papers on Sand

Two papers dealing with sand control problems were presented at the second session Saturday morning under the chairmanship of Dr. H. Ries, geology department, Cornell university. The first paper "Relation Between Casting Defects and Sand Properties" was presented by Harry W. Dietert, president Harry W. Dietert Co., Detroit. The second paper "Tests of Steel Sand Mixtures at High Temperatures" was presented by H. L. York, experimental engineer, Cornell university.

Mr. Dietert explained that a mold passes through six stages during the pouring and setting of the metal and then showed the presence of certain factors at any of these stages may cause a defect in the casting. For example where the skin of the mold gives off gas from moisture and combustible material the remedy is to increase permeability, decrease mold hardness and in some instances increase the sprue height. Other examples illustrated by slides included blows from mold or core, pin hole defects due to sand where clay content is low and sand is high in permeability but worked at a high moisture content. Exception was noted in cases where the pin holes originate in the metal.

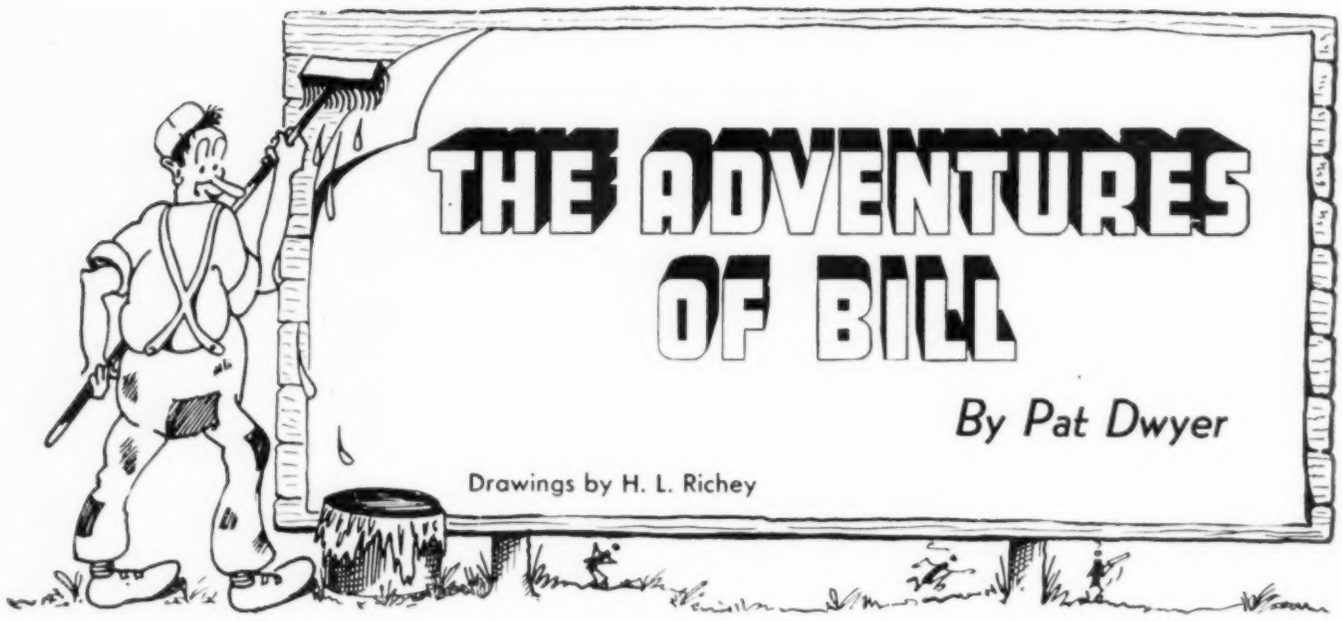
Other casting defects may be traced to excessive, or insufficient hot strength of the sand. While in other instances the defects are caused by expansion of the mold skin. These defects may take the form of rat tails or buckles and are caused by radiated heat from the rising metal in the mold striking the skin and expanding a thin layer of sand. A slip plane is developed which relieves the compressive force set up by the expansion. The remedy is to reduce mold hardness and work sand at a conservative strength and moisture content.

Work described in the paper presented by H. L. York represents results of experiments outlined by the subcommittee on steel sands and carried out under auspices of the A.F.A. in the engineering laboratory of Cornell university. The author explained that the work still is in progress and the paper simply was a progress report.

Effect of Bonding Materials

Object of the investigation was to determine how steel sand mixtures behave when heated to different temperatures as regards compressive strength, expansion and contraction, and also to determine the individual effect of different bonding materials. The paper, copiously illustrated with charts, presented in detail the results of the wide range of experiments. Tentative conclusions showed that sands crushing under load at temperatures under 1150 degrees Cent. (2102 degrees Fahr.) show no sign of fusing. There is no visible difference between a broken sample and the same sample mashed at 10 degrees higher temperature. Bentonite bonded sands disintegrate completely upon cooling from temperatures above 900 degrees Cent. (1652 degrees Fahr.) provided they are not fused. The bond does not appear to hold them together. Rate of cooling merely affects the time of complete disintegration. Fire clay bonded sands do not crumble upon cooling from any high temperature, except those which might by severely affected in the shock test.

At the concluding session under the chairmanship of H. H. Judson, Gould's Pumps Inc., Seneca Falls, N. Y., a paper on elementary metallurgy was presented by H. C. Waldron, assistant foundry superintendent and metallurgist Nordberg Mfg. Co., Milwaukee. Taking a liner as a typical casting he explained the chemical and physical properties of the casting in thicknesses varying from ¾ to 4 inches and how the composition of the charge is manipulated to meet certain specifications.



THE ADVENTURES OF BILL

By Pat Dwyer

Drawings by H. L. Richey

OCCASIONALLY the family cat Victoria joins Bill and me and listens gravely while we discuss any subject that comes to mind. Usually she sits primly on her haunches and blinks her eyes now and again to mark her approval or dissent. She changed the program the other night by boldly jumping on Bill's lap where she stretched out luxuriously and pretended to go to sleep. I ventured the opinion that I did not believe cats ever slept. Just shut their eyes and went through the motions.

"That's where you are wrong," said Bill, "and to prove that you are wrong I only have to quote a bit of rhyme which bubbled out of Rob Burns when he gazed on an old tom cat asleep on the hearth: 'Hoo Ah envy ye, ye scut,' says brave Rob, 'Na bills to pay, na lines to write. Sleep a' day an' prowl a' night!'

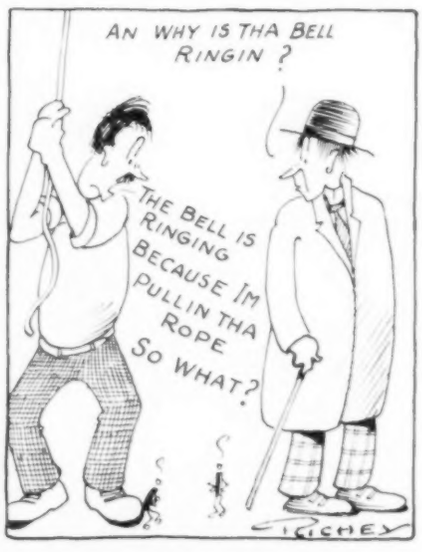
"Wonderfully intelligent animals," he continued smugly, "very dainty and discriminating. You don't see 'em sitting on the lap of every Tom, Dick and Harry."

He airily waved aside my brief comment that cheese is used to bait mousetraps. Victoria erroneously may have fallen into a natural error and assumed that she was in the vicinity of the happy hunting ground. He stroked the cat's back and then probably through association of ideas asked me if I ever had heard of a lad known as Archie-bell-the-cat.

"No," I said. "Friend of your's from the cheese belt?"

"Just goes to show you," said Bill, "how easily and spontaneously nicknames are bestowed in Scotland. I have no figures by me at the moment, but I feel quite safe in claiming that every second man, woman and child in the country bears a name other than the one bestowed upon him, her or it by the loving parents. Those who have no nicknames are known by a contraction or diminutive of their given names. For every David Livingstone there are a hundred Davies and for every Robert the Bruce you will find a thousand Robs, Rabs and Rabbies. This good old custom dates back as far as we have any record and apparently was well observed at the time a group of Scottish noblemen decided to slip the skids under several favorites of King James III. Possibility that James might not favor this skidding program prompted one of the lads to ask 'Who is going to bell the cat?' Impatient Archie Douglas fifth earl of Angus declared he would do that little deed with his own hands and with the greatest of pleasure. Ever afterward he was known as Archie-Bell-the-Cat."

"Your reference to bells," I interrupted at this point, "reminds me that I had a letter recently from my old friend H. H. Miller, who conducts a nonferrous foundry in Torreon, Mexico. He enclosed the picture of a bell he had cast for the cathedral in Durango and in addition he enclosed pictures of several ancient bells that had been in service for many years."



He learns something every day

"Funny thing," said Bill, "whenever any person mentions bells I think of a sturdy hunk of canned humor which appears periodically in house organs and similar publications. A stranger in a small town happened to pass a church while the verger was ringing the bell. Since the day was not a Sunday, a High day nor a Holy day, the stranger's curiosity was mildly aroused. He tapped the bell ringer lightly on the shoulder with his cane.

"'I say me good man,' he inquired courteously, 'Why is the bell ringing today?'

"The sourpuss ringer was in no mood to bandy words with strangers.

"'The bell is ringin'.' His voice was not that of a cooing dove. 'The bell is ringin' because I'm pullin' the rope. That's why the bell is ringin'. Want to make something out of it?'

"Reference to this incident is not introduced with the object of arousing antagonism toward the bell ringing tribe—by and large peaceful and inoffensive citizens—but to direct attention to the interest in bells displayed by practically every person. If proof is required for this statement—heaven knows why any person should even think of such a thing—if proof is required, all one has to do is pause for a moment and reflect on the multitude of ref-

(*Continued on page* 58)

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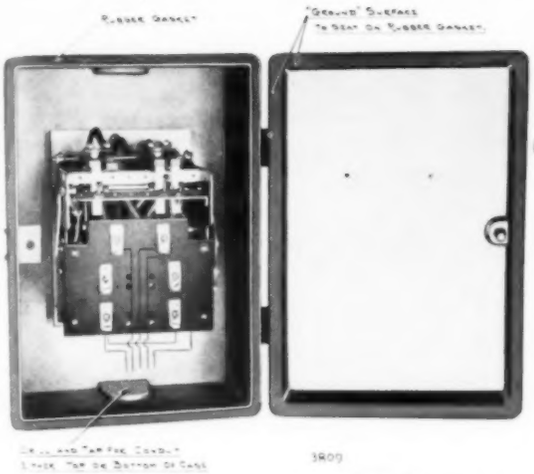

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BLAST CLEANING EQUIPMENT SLY TUMBLING MILLS

DUST CONTROL EQUIPMENT FOR EVERY INDUSTRIAL PURPOSE

(*Continued from page* 56)

erences to bells in English literature. Practically every one of the great masters of prose and verse has taken a bang or two at the bells at one time or another. Would they—the proposition is laid before you as man to man—would they have sweated blood, spilled gallons of ink and—er—so forth, in conception and travail, if the great public was not ready and anxious to clasp the result to its collective bosom. Certainly not.

"Parlor, church and village hall entertainments practically have disappeared since the advent of the movies and the radio, but at one time well within the memory of those with incipient jowls, eye pouches and adipose tissue amidships," here he gave me a nasty eye, "no program was complete without *The Bells* by the late E. A. Poe. Some of the performances were middling, some were so-so and some simply were awful. Range of the human voice is limited and the spread between the tinkle of the tiny silver bells and the deep ding-dong of the slowly tolling funeral bell usually provoked more ribald mirth than admiration. The poem is the best, and through its universal appeal, probably is better known than any other composition on the subject in the English language. However, the appeal and the sentimental pull at the heart strings has been gained from the p r i n t e d presentation, and not through pitifully gymnastic vocal presentation with gestures.

"If—and full cognizance is taken of the fact that this is a debatable point—if there is any thing in the old saying about bodies in the grave turning over in protest against calumnies and indignities, the late Mr. Poe in a future incarnation readily can quality for membership in Tent No. 1, Ancient and Exalted

From an old print: The Martyr

Whirling Dervishes of the Desert and Dust Blown Trails from Wahoo to Denver.

"Admirers of another sterling journeyman poet, Mr. Longfellow, to wit, will remember his reference to a bell in the *Wreck of the Hesperus*. O, father I hear a church bell ring, O, say where can it be? 'Tis a fog bell on a rock bound coast, and he steered for the open sea.

"Quite the proper course to pursue under the circumstances and a credit both to the author's knowledge of seamanship, and to the judgment of the old sea dog, tanned to a rich brown, pickled in brine and probably smelling horribly of wet sea boots and dead fish.

"His judgment was sound and no doubt would have been marked down to his credit if and when a board of marine underwriters had sat on the case. Unfortunately, and this factor probably would have canceled the other, he did not steer for the open sea soon enough. Thousands of tender little hearts have ached, and twice that number of innocent childish eyes have brimmed with tears over the verse which relates that at daybreak on the bleak sea beach a fisherman stood aghast to see the form of a maiden fair lashed close to a drifting mast. The salt spray was frozen on her breast and the salt tears in her eyes, and he saw her hair like the brown sea weed, on the billows fall and rise.

"Temporary or permanent exiles from the land of their birth see other names and other places in their mind's eye, but the sound of a bell arouses the pride and pathos which prompted another exile, Francis Mahoney, better known as Father Prout, to compose *The Bells of Shandon*. One does not need to be a Corkonian to realize the beauty and swinging melody of the verses beginning: With deep affection and recollection I often think of those Shandon bells, whose sounds so wild would in days of childhood fling round my cradle their magic spells. On this I ponder where e'er I wander and thus grow fonder sweet Cork of thee, with thy bells of Shandon that sound so grand on the pleasant waters of the river Lee.

"Lovers, young and old, and other people with absolutely no excuse in solo, duet and quartet, have been going to town as the saying is for several years on the bells of St. Mary's linked up intimately with the young love, the true love and—er—all that kind of stuff. The cockney Englishman is moved to pull a forelock and make a leg when any person mentions Big Ben or Bow bells. Patrons of the drama of an earlier day sniffed audibly or dabbed wet eyes when the juvenile heroine of *Ten Nights in a Barroom* piped the ditty: Father, dear father come home with me now, the clock in the steeple strikes one. On more than one occasion the sweetly sentimental atmosphere was wrecked by a rude voice from the gallery demanding to know: 'One what'?

"The sound of a cow bell arouses nostalgic memories in the mind of a country bred boy now happily located in the city and taking a run down home Sunday in the new car which will be his if and when he makes 17 more payments. He recalls with pride that at any distance and at any time he could recognize any cow by the sound of the bell. A very useful piece of knowledge when one of these perverse brutes with truly diabolical and satanic cunning managed to lose herself miles from home in a swamp or piece of timber land filled with underbrush and windfalls and apparently impenetrable to anything larger or less slippery than a weasel."

"Seems to me," I said, "that even a robust weasel in the pink of con-

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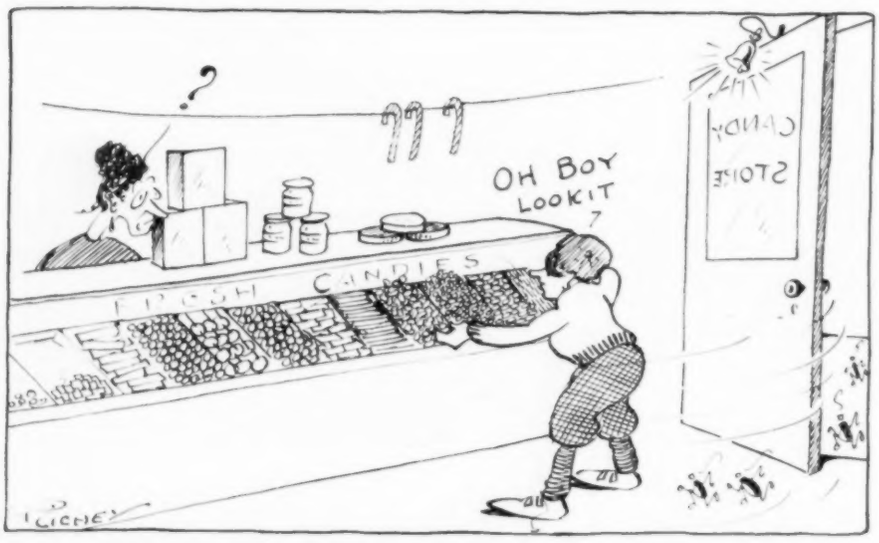
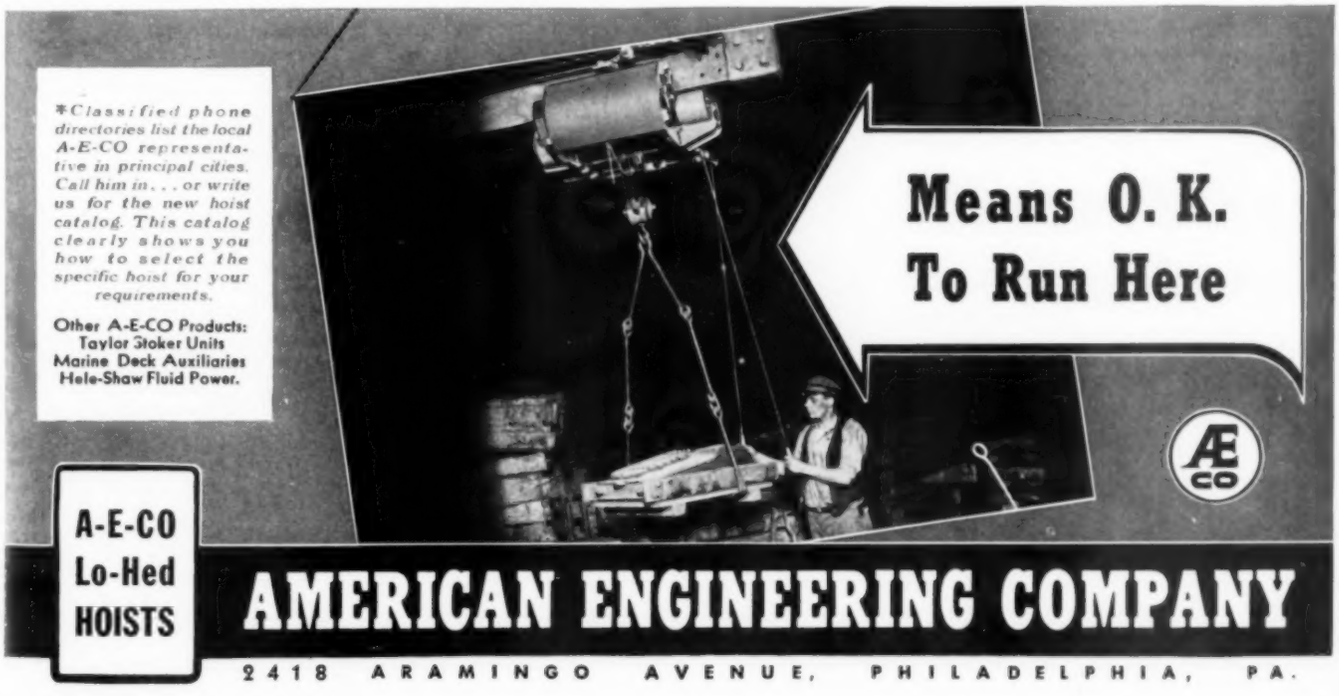


A watchful eye is rather to be chosen than a boy's conscience

Choose THE hoist which will run on standard I-beams or tracks of any make. Ask the nearest A-E-CO representative* to tell you how easily Lo-Hed Hoists can be adapted to run on your track system. Ask him to explain Lo-Hed's exclusive features that give you fast, dependable operation with minimum maintenance cost. Let him show you Lo-Hed's uses in scores of industries. Find out *why* Lo-Hed is the logical hoist for EVERY purpose and why it is the *only* hoist for low headroom conditions. A-E-CO Lo-Hed Hoists are built in many standard models, from ¼ to 12 ton capacities.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Northern Iowa

REGULAR monthly meeting of the Northern Iowa Foundrymen's association was held in Waterloo, Iowa, Nov. 22. Fifty members and guests attended to hear John W. Kelin speak on "Selection and Use of Nonferrous Alloys." Mr. Kelin is assistant sales manager of Federated Metals division, American Smelting & Refining Co., St. Louis, and secretary-treasurer of the St. Louis District chapter of the A. F. A. He recently was made chairman of the nonferrous round table for the annual convention in Cincinnati, O., May 15-18, 1939.

The speaker discussed processes of producing nonferrous ingot metals and precision and care required to obtain proper composition. Mr. Kelin pointed out that even the best alloy, will not produce good castings unless correct melting and pouring temperature, flux, good molding practice and proper sand and cores are used. Melting and pouring temperatures should be checked carefully with accurate pyrometers.

Slides were used to show cross sections of ingots of various composition and physical properties of various nonferrous alloys. Another slide showed recommended properties which molding sand should have for castings of various sizes. Considerable discussion followed the talk in which the speaker included interesting personal experiences and sidelights.—*R. E. Wilke, president.*

Buffalo

SIXTY-FIVE members and guests of the Buffalo chapter of A. F. A. attended the regular meeting Dec. 5 at Hotel Touraine. Immediately following dinner, a local magician put on a show which was a masterpiece. He produced cards from nowhere and several sales managers wanted him for their sales forces to see if he could help with slow coming orders.

M. W. Pohlman, Pohlman Foundry Co. Inc., and chairman of the chapter, announced the Big Stag Night will be held on Jan. 9. Dinner, free liquid refreshments and a corker of a floor show will be on the bill.

William J. Shennan, foundry consultant, Taggart & Co., Philadelphia, spoke on, "Common Sense Foundry Practice." Mr. Shennan drew from his wealth of experience to tell of some intricate castings made years ago and how some of the large ones were handled. The meeting gradually developed into a general discussion, with Mr. Shennan acting as leader and drawing comments from the listeners. From a discussion standpoint, it was one of the chapter's best meetings, members present really opening up, asking for and receiving valuable information.—*J. R. Wark, secretary.*

Metropolitan

EXTRA care in molding procedure often spells the difference between profit and loss on a casting, Pat Dwyer, engineering editor, THE FOUNDRY, Cleveland, told members of the Metropolitan N. Y.-N. J. chapter, of A. F. A. at the Essex House, Newark, Monday evening, Dec. 5. His subject was "Gates and Risers." More than 70 were present.

Many castings, he said, require only the simplest molding procedure, but fully 50 per cent, due to style, size and so forth, require more than routine attention, and in some cases substantially more. "Why should a foundry," he inquired, "begrudge a molder an extra half hour of time, when failure to do so might cost the company $40 or so on a casting?"

On the other hand, he warned against long and involved processes, where it is possible to avoid them, citing some "horrible examples," where the results were not worth the time and effort involved.

The speaker illustrated his remarks with lantern slides, one of which showed 32 types of gates, runners and risers, from which, he said, an almost endless number of combinations could be evolved. These types ranged from those of more or less general application to those of more specialized use, such as the horn gate and wedge gate, used to quite some extent in the manufacture of sanitary ware, the ring gate, used principally for pouring pipe up to 12 and 16 feet in length, and the tile gate, frequently employed in large molds.

He discussed various *traps* designed for getting clean metal into the casting. He pointed out that while it ordinarily should not be necessary to have to resort to such devices, they nevertheless were undoubtedly desirable in many cases. Various illustrations of what and what not to do in the matter of traps were presented by the speaker.

Illustrations included molds for cast iron rolls, designed for pouring metal at the bottom, but with provision also for feeding from the top. Bathtub molds also were shown, with provision for pouring metal from the top. Pouring from the top is ideal where it can be done, he added.—*B. K. Price.*

Pittsburgh

DEOXIDATION practice and origin of some defects in castings were discussed by C. E. Sims, Battelle Memorial institute, Columbus, O., at a meeting of the Pittsburgh Foundrymen's association held Monday, Nov. 21 at Fort Pitt hotel, Pittsburgh.

Speaking to about 125 members and guests, Mr. Sims outlined the values of oxygen in steel casting procedure and the damage which the presence of hydrogen may cause. Methods of removing hydrogen from steel castings were enumerated.

Deoxidizing agents, such as carbon and silicon, and their effects on steel at various temperatures were demonstrated. Prime purpose of deoxidation is to form water vapor which then will absorb and remove hydrogen from the molten casting, thus

minimizing blowholes. Aluminum is one of the most efficient deoxidizing agents, 0.01 per cent of aluminum in steel holding the oxygen, present as an iron oxide, down to 0.002 per cent.

Water is the prime cause of blowholes, pinholes and similar defects. This has been shown by substitution of hydrocarbons such as gasoline or benzine for water in the molds.

Types of blowholes and pinholes and causes of their formation were fully discussed. Most generally there is from 1/32 to 1/8-inch skin on the surface of the casting above the holes. Some holes, especially those on vertical surfaces, are formed by water vapor formed on the mold surface. Holes on the horizontal surfaces are generally formed by presence of foreign material which has floated to the top.

Discussion on Mr. Sims' talk was led by R. C. Heaslett, chief metallurgist, Continental Roll & Steel Foundry, Pittsburgh.—*R. L. Hartford.*

Twin City

SECOND meeting of the Twin City Foundrymen's association was held Nov. 14 with 26 present representing 11 foundries. A turkey dinner was served at the Commodore hotel in St. Paul at 6:30. A brief business session followed the dinner at which Fred Kaim, vice president of the association, presided. The meeting then adjourned to the Twin City sewage disposal plant for an inspection trip.—*O. W. Potter, secretary.*

N. Ill. and S. Wis.

OVER 60 attended the regular meeting of the Northern Illinois and Southern Wisconsin chapter of A.F.A. Nov. 8 at Hotel Freeport, Freeport, Ill. John T. Clausen, Greenlee Bros. & Co., Rockford, Ill., chairman, presided at the meeting which featured a talk on "Foundry Cost Methods for Gray Iron Foundry," by William J. Grede, Liberty Foundry Co., Wauwautosa, Wis.

Mr. Grede's discussion brought out the need of a standard cost system in the foundry industry and some of the purposes of the A.F.A. committee on costs. The speaker listed the accomplishments of that committee and the work being done at present, and invited anyone interested to attend the cost committee meetings of the Wisconsin chapter of the A.F.A. He also described the cost system of the Liberty foundry. A lively discussion followed the presentation.—*Henry C. Winte, technical secretary.*

Southern California

A GROUP of 89 attended the regular November meeting of the Southern California chapter of A.F.A. held at the Clark hotel in Los Angeles, Nov. 17.

Gary Breckner, radio announcer of "KNX", Columbia Broadcasting Co., Hollywood, Calif. presented a coffee talk on "Behind the Scenes in Radio."

The guest speaker George W. MacKenzie, assistant supervisor trade and industrial education of Los Angeles schools, outlined the three types of vocational education that the Los Angeles school system is using. Evening trade extension program held in various night schools; pre-apprenticeship program held at manual arts high school, a 2-year course for boys who spend the mornings in the school foundry with the afternoons in classrooms studying English, etc.; apprenticeship system for men who are regularly employed and are paid by their employers to attend the Frank Wiggins trade school 4 hours a week.

The speaker then gave details of the evening extension foundry apprentice training course that would be started shortly at the request of the chapter. This course will be held Wednesday evenings at the manual arts high school. There is no charge since this is part of a $21,000,000 program the government is making available to any community which will provide an equal amount for such work. Men eligible to enroll must be recommended by some foundry, desire to continue in foundry work, and attend regularly until the course is completed.

Frank Britt, instructor for the course, spoke briefly stating the course would include practical instruction, both in the classroom and in the school's foundry.

J. G. Eberhart, foundry superintendent, Kay-Brunner Steel Products Co., read a paper submitted by H. O. Behrendsen, foundry technician, F. E. Shindler Co., Joliet, Ill., on bentonite in molding sands. The paper contained useful suggestions applicable to both large production plants and small jobbing shapes.

Round table forum on "Sand Problems" included gray iron, steel and nonferrous. L. O. Hofstetter, H. C. Donaldson Co., was discussion leader on gray iron together with James E. Eppley, Kinney Iron Works; Walter C. Patterson, General Electric Co. of Ontario; Pasquale Arpea, Axelson Mfg. Co.; and Charles Gregg, Reliance Regulator Corp. co-operating. Discussion included use of bentonite, fireclay or similar bonds in gray iron sands and it was agreed that in order to make full use of clay additions, sand conditioning is essential.

B. C. Emmett, Los Angeles Steel Casting Co. was discussion leader on steel sand with assistance from Hayes Schlundt, Columbia Steel Co.; Harry E. Blood, sand producer; E. C. Hummel, Utility Trailer Mfg. Co.

Among the questions discussed was "Is it possible to use 100 per cent reclaimed sand in the process of manufacture of steel castings?" It was the general opinion that it was possible provided the sand grain size was held to close limits, such as 75

(*Continued on page* 63)

Over 600 members and guests of the Northeastern Ohio chapter attended the annual Christmas party held Dec. 14. Illustrations through courtesy of Sterling Farmer, Sand Products Corp., Cleveland

A GOOD NEW YEARS Resolution!

Resolve to eliminate all dust in your foundry the most practical, efficient, inexpensive way—the Schneible Multi-Wash Way! It won't be for only 1939. Plan for the future—a Schneible System will serve indefinitely.

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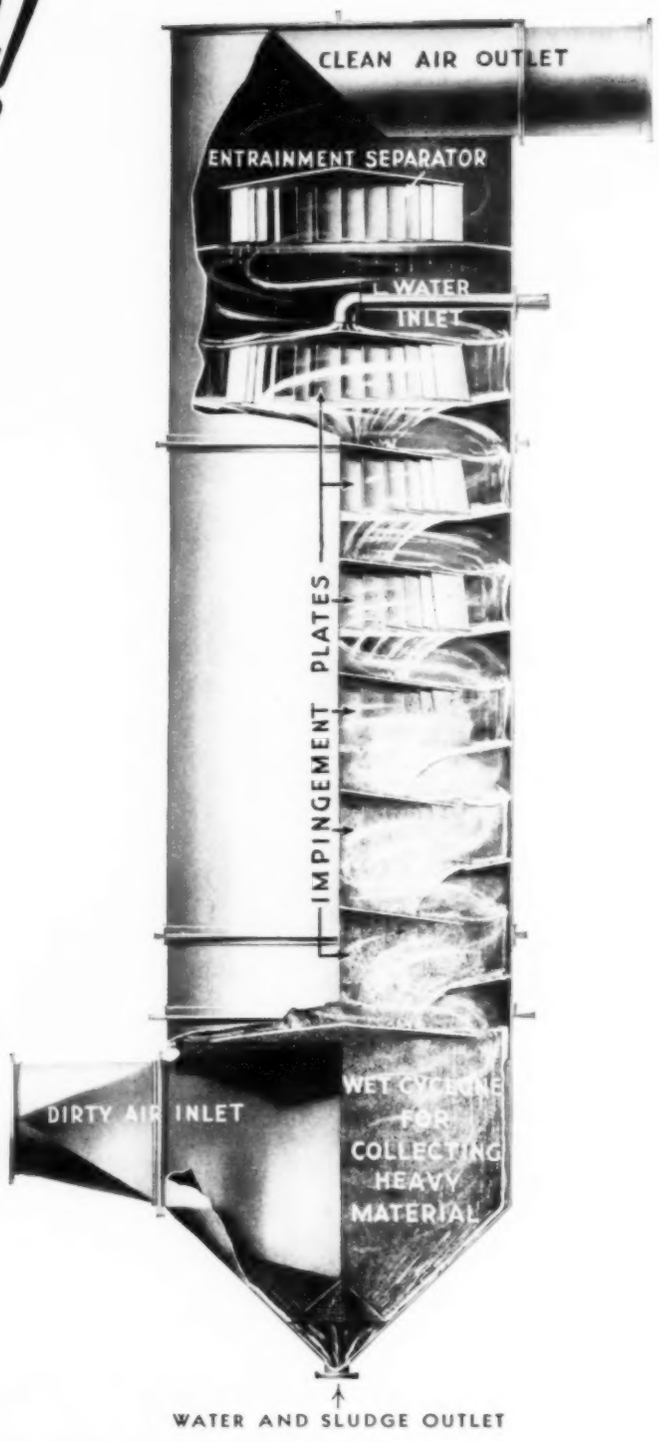

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(*Continued from page* 61)

per cent on two screens and that iron oxide particles were removed successfully.

Roy E. Payne, Aluminum Co. of America was discussion leader on nonferrous sands with the help of Charles R. McGraw, Long Beach Brass Foundry; and Fred Edmison, Mechanical Foundries Inc.

Sixteen local foundries supplied the chapter with copies of pattern storage record cards with explanations of how the cards are used. These were mounted and displayed so those interested could study the records before and after the meeting.

J. G. Coffman, chairman of the chapter, appointed the following men to serve on the committee to handle arrangements for a joint meeting of the Los Angeles and San Francisco chapter to be held at Fresno, Calif., April 22, 1939. Clyde Hopping, Alhambra Foundry, chairman; James E. Eppley, Kinney Iron Works; L. O. Hofstetter, H. C. Donaldson Co.; Bert Oldfield, Alhambra Foundry.

G. W. Merrefield, Kay-Brunner Steel Products Co., chairman of the program committee, arranged the technical program which was one of the best and which was ably handled. —*M. S. Robb, secretary.*

Ontario

MEETING of the Ontario chapter of the A. F. A. on Nov. 25, at Rock Garden lodge, Hamilton Ont., featured W. F. Piper, Beardsley & Piper Co., Chicago, who presented through the media of motion pictures and descriptive comment, information on foundries in many corners of the globe. In addition to foundry views, the pictures covered much of the scenic beauty of a number of countries visited by the speaker.

Chief interest of the travelogue centered on contrasting methods of operation in some of the more up-to-date foundries in the world with those of more primitive establishments. To secure the pictures and information necessary to present these contrasts, the speaker traveled about 40,000 miles, visiting Hawaii, Philippine Islands, Japan, China, East Indies, Australia, Malay States, Indo China, India, Palestine, Syria, Greece, Italy, Switzerland, France, Belgium, Holland, Denmark, Norway, Sweden, Great Britain, and Ireland. He saw all types of foundries in operation and studied the founders' art of the past as represented by cast metal objects preserved in temples and other repositories of ancient civilizations.

Among the pictures which best brought out the contrast between old and new foundry operations were those of the Irrawadd Flotilla Co. foundry in Rangoon and of the Allis-Chalmers plant in Milwaukee. In the latter plant were shown sandslingers, modern molding and materials handling equipment and all types of mechanism that contributes to efficiency and productivity in the large foundry. In the plant at Rangoon, although the essential operations of good founding are accomplished, labor of man and beast is not spared. Materials are screened on a hand screen worked by three men. A heavy cylindrical stone pulled in a circular path by two oxen is used in mulling facing and core sand, and clay for loam molds and for daubing the cupola. Molding is all done on the floor by molders who sit at their work.—*G. L. White*

Reading

THE Reading Foundrymen's association re-elected Julian B. Greenstreet, superintendent, Textile Machine Works, foundry division, Reading, Pa., president, at its annual meeting Nov. 22 at the Wyomissing club, Reading, Pa. Other officers elected for the coming year are as follows: E. J. Snell, Keystone Foundry Co., Lebanon, Pa., vice president; G. W. Shomo, Confer, Smith & Co. Inc., Hamburg, Pa., treasurer; H. C. Cummings, Reading, secretary.

Members of the executive committee are: W. M. Davies, Reading Foundry & Supply Co., Reading; G. R. Young, Empire Steel Castings Inc., Reading; B. W. Edris, Berks Foundry & Mfg. Co., West Hamburg; L. C. Wilson, Reading Steel Castings Co., Reading; C. H. Meminger, Lancaster Iron Works Inc., Lancaster; H. F. Scatchard, Birdsboro Steel Foundry & Machine Co., Birdsboro.

Following the business meeting a floor show was enjoyed greatly by over 100 members and guests representing concerns in Pennsylvania, New York, New Jersey, and Delaware.—*H. C. Cummings, secretary.*

New Jersey

RELATIVE merits of cast iron and welded steel for various applications were discussed at the meeting of the New Jersey Foundrymen's association in the Downtown club on Dec. 14. D. H. Montgomery, vice president, New Britain Gridley Machine Co., New Britain, Conn., guest speaker, talking with particular reference to machine tools, believed that an emphasis had been placed on the use of fabricated steel which was unwarranted. He thought that gray iron foundrymen could do much in combating the inroads of fabricated steel and machine tool industry by making greater study of the behavior of cores and molds in the production of castings. Approximately 80 were present.

Mr. Montgomery's talk was supplemented as a part of the scheduled program, by informal remarks by three local foundrymen, namely, John A. Bukowski, works metallurgist, Worthington Pump & Machinery Corp., Harrison, N. J.; G. L. Cheasley, manager, Thatcher Furnace Co., Newark; Leonard Box, superintendent, Dietrich Foundry Co., Newark.

John L. Carter, secretary, announced the appointment of a technical committee, whose function will be to select speakers and plan methods for enlivening the association's technical meetings. Members of the technical committee include Mr. Bukowski and Mr. Box; H. L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J.; George R. Farrell, Flockhart Foundry Co., Newark; A. P. Grim, Grim Foundry Co., Bound Brook, N. J.; C. A. Hartman, R. Hoe & Co., Dunellen, N. J.; G. E. Hochgesang, American Saw Mill Machinery Co., Hackettstown, N. J.; David MacIntosh, Sacks-Barlow Foundries, Inc., Newark; W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J.; Henry Reitinger, United States Pipe & Foundry Co., Burlington, N. J.; and A. E. Winsted, Moore Bros. Co., Elizabeth, N. J.

Mr. Montgomery said that, judging from his experience, the costs of welded steel and gray iron castings, respectively, were about comparable up to the point where machining was necessary. Beyond that the costs were all in favor of the gray iron casting. It is true, he said, that less machining usually has to be done on a fabricated steel section, but that more time is required. He estimated that on a number of occasions the cost of machining a fabricated section was three times as much as machining a gray iron casting. However, some parts, he said, were ideal for rolled steel. For instance, he mentioned doors, which are subject to warping when constructed of cast iron.

He thought most castings could be made to close specifications. "I can see no excuse for a casting varying ½ to ⅝ or more an inch on a 5-foot length when it is an all-cored job. I can't see why a casting cannot be made as accurate as a steel frame." Better design and better patterns would often help materially, he admitted.

The speaker attributed some of the enthusiasm for fabricated steel in machine tool design to a "fadism," which he thought would pass; and as a side remark said he believed that the use of hydraulics in machine tool design has been somewhat overdone for the same reason and was "fading."

Mr. Montgomery expressed the

opinion that the time will come when gray iron castings can be welded into the fabricated structure. He thought that that would impart a considerable impetus to demand for both types of construction in the general industrial field.—*Ben K. Price.*

Birmingham

A LARGE number of foundrymen and their friends gathered Nov. 18 at Hotel Tutwiler, Birmingham for the regular meeting of the Birmingham District chapter of the A. F. A. After the dinner the group assembled in the ball room for the second meeting of the present year. C. B. Saunders, Tennessee Coal, Iron & R. R. Co., chairman, presided and dispensed with preliminaries to give the program as much time as possible.

W. F. Piper, Beardsley & Piper Co., Chicago, was the speaker and he showed interesting moving pictures taken on his recent trip around the world. First pictures showed foundries in India, China and other countries and then pictures of some modern foundries gave a comparison of foundry technique practiced throughout the world. Mr. Piper then showed pictures depicting life on some of the South Sea islands as well as in several thriving Australian cities.

The program chairman announced that progress was being made on lining up the program for the regional meeting which will be held Feb. 23 and 24, 1939.—*W. O. McMahon, secretary-treasurer.*

Chicago

NOVEMBER meeting of the Chicago chapter of A.F.A. was held at the Medinah club, Chicago, Nov. 14. More than 160 members and guests were present at the dinner preceding the meeting, while an equal number in addition filed in as the meeting began, bringing the total attendance to well over 300.

Continuing with its policy of this season presenting programs of broader interest, the chapter had as speaker of the evening Walter E. Hadley, manager of operations, Chicago district, Carnegie-Illinois Steel Corp. Mr. Hadley traced the development of the iron and steel industry in Chicago from its inception to the present time, noting the great advances in capacities and production. Mr. Hadley's address was designed as a fitting preface to the showing of United States Steel Corp. subsidiaries' technicolor motion picture, "Steel—Man's Servant."

During the business portion of the meeting, J. J. Fox, Wisconsin Steel Co., chairman of the chapter's membership committee, reported on the new members obtained in the past month and emphasized the need for a more concerted membership drive.

"Problems, Applications and Production of Gray Iron Castings" was the subject of M. J. Gregory, principal speaker at the December meeting, Chicago chapter, held Dec. 12. Mr. Gregory is factory manager, Caterpillar Tractor Co., Peoria, Ill., and being an outstanding foundryman as well as chairman of the Quad-City Chapter, a large group of Chicago members and guests turned out to hear his discussion. Approximately 180 attended the dinner preceding the meeting, while over 225 were present for the address.

The speaker mentioned the subject of apprentices at his plant and complimented the Chicago chapter on the manner in which it has encouraged apprentices in the foundry field. Entering the technical phase of his talk, Mr. Gregory explained the foundry operations at the Caterpillar plant, describing the melting and molding equipment and giving details of cycles and charge properties. Consistency of the physical results was chief among the points discussed, as well as an emphasis on the value of impact testing.

Lantern slides were used by Mr. Gregory to illustrate salient points throughout the discussion, and of particular interest to the attending group were samples of castings, molds, and rough and polished sleeve liners displayed to the audience.

January meeting of the Chicago chapter, to be held Jan. 9 at the Medinah Club, will have as principal speaker, S. Wells Utely, president, Detroit Steel Casting Co., and past president, American Foundrymen's association. His subject is as yet unannounced but is calculated to be of general interest to all executives and foundrymen.—*J. F. Powell.*

New England

A RECORD crowd of nearly 100 members and guests attended the meeting of the New England Foundrymen's association on Dec. 14 to hear George S. Evans, Mathieson Alkali Works Inc., New York, speak on the subject of "Refining Cast Iron." Mr. Evans related how desulphurization of iron and steel was tried as early as 1880, but the process lay dormant until after the World War when the quality of scrap and coke made it necessary to seek a method to reduce sulphur content.

The trade name purite is given the material which is fused sodium carbonate. The active ingredient is sodium oxide, and simple chemical equations were given to explain the ability of that material to remove sulphur from iron and steel. According to the speaker the higher the sulphur content in the iron, the more easily it is reduced, and consequently the less sodium carbonate is required. In other words a sulphur content in the iron of 0.175 per cent is reduced to 0.140 per cent or approximately 17 per cent, more readily than a 0.090 per cent sulphur is reduced to 0.080 per cent or a reduction of only 11.1 per cent.

Soda ash in the cupola accelerates combustion and reduces oxidation as well as sulphur content of the iron. Mr. Evans spoke at length on the advantages of the mixing ladle used in connection with cupolas where fused sodium carbonate is used. In explaining the use of that material in the air furnace, he pointed out that it was absolutely necessary to have the bath free from slag, and added that due to the shallow depth of iron, sulphur reduction was less efficient with this medium of melting. Many slides were used to show various phases, and the number of questions asked the speaker at the conclusion of the talk indicated the interest of the members.

A nominating committee appointed at the meeting to select candidates for next year's officers consist of the following past presidents of the association: A. S. Wright, Hunt-Spiller Mfg. Corp., Boston; George Thomberg, Crescent Park Brass Foundry, Waltham, Mass., and Walter Saunders Jr., Walter A. Saunders Co., Providence, R. I.—*M. A. Hosmer.*

Philadelphia

METROPOLITAN Philadelphia chapter of A.F.A. held its regular meeting Nov. 11 at the Engineers club with an attendance of 135, Harold L. Henszey, Carborundum Co., Philadelphia, chairman, presiding.

Dr. G. H. Clamer, president, Ajax Metal Co., introduced H. J. Rowe, Aluminum Co. of America, foundry division, Cleveland, who spoke on "Aluminum Alloy Castings, Their Manufacture and Use." Mr. Rowe stated that although aluminum is one of the most recent metals to be used for casting, the rapid development of the industry indicates that castings of that metal contain particular properties for which their many uses have been created. Properties of outstanding significance are: Low specific gravity; high strength-weight ratio, particularly in the case of heat treated alloys; high thermal and electrical conductivity; resistance to various corrosive mediums; and relative ease of finishing, either by machining or polishing.

Pure aluminum seldom is used for castings, since it is comparatively soft and does not possess desirable casting characteristics. By adding various alloying elements or hardeners, suitable alloys have been developed with both improved casting characteristics and physical proper-

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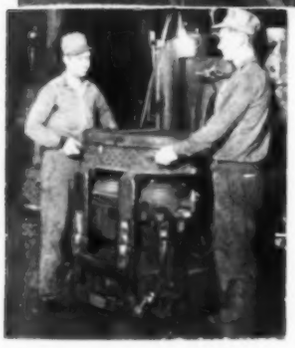

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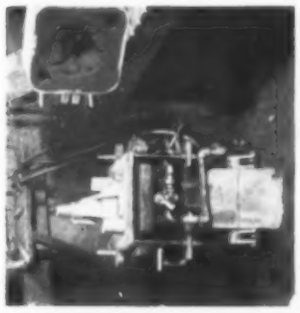

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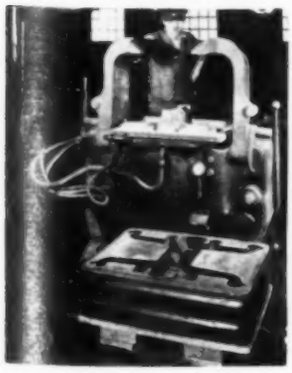

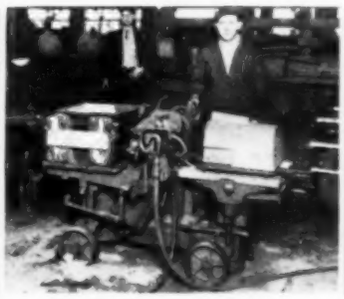

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ties. By alloying alone, strengths about twice those of pure aluminum are developed. In addition, certain elements are susceptible to heat treating processes which further increase strength. Thus a great many aluminum alloys are available today, providing a wide range of properties and other characteristics desired for engineering purposes.

Like other ferrous and nonferrous alloys, aluminum alloys possess inherent properties which have a direct bearing on methods used for handling them in the foundry. Such properties as low specific gravity, hot shortness tendencies, high crystallization shrinkage and oxidation characteristics must be understood to provide the foundry practice best suited for production of the alloys. Majority of foundry trouble encountered with aluminum alloys can be traced to melting and pouring practice, or gating, risering or chilling practice, employed without consideration of these characteristics.

Melting and pouring temperatures have a greater effect on properties of aluminum alloy castings than generally may be recognized. However, a casting poured at the lowest possible temperature will have finer grains, fewer defects and higher mechanical properties than the same casting poured at a higher temperature. Unlike ferrous alloys, aluminum does not reflect its temperature by its color, and control of that factor requires suitable pyrometric equipment.

Strength of aluminum alloy castings, as well as general soundness, is dependent on the gating employed. Ideal gating provides a uniform, rapid and progressive solidification, proceeding from points farthest from the gates and risers toward the gated areas. In sand molds that condition is obtained by proper location and size of gates and careful use of risers and chills.

An after dinner talk was given by Dr. Stanley P. Reimann, internationally known cancer expert. Dr. Reimann is head of cancer research at Lankenau hospital and is professor at the University of Pennsylvania medical school. His talk, "Cancer and Cancer Growth," was illustrated with many slides and he was introduced by Lee Harris, general manager of Olney Foundry Co., Philadelphia.

An interesting talk on "Radiography" by R. A. Gezelius, metallurgist, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., featured the regular meeting of the Metropolitan Philadelphia chapter held Dec. 9. Harold Henszey, Carborundum Co., and chairman of the chapter presided at the meeting attended by approximately 145. The after dinner talk was presented by Charles H. Grakelow, president, Poor Richard club and former director of public welfare, Philadelphia. Mr. Grakelow spoke on "Citizenship."

Mr. Gezelius presented his highly technical subject in a most pleasing and simple manner and illustrated his talk with many interesting slides. Briefly he commented that specifications today are becoming more difficult, all methods of nondestructive testing are of greater importance than ever before. Radiography therefore, is creating more interest than at any previous time. Practically every technical society now has a committee studying this subject which a few years ago was not considered of much importance generally.

To appreciate radiography and interpret results obtained, it is essential to know something of the fundamental principles involved. Gamma rays and x-rays are members of a family of wave motions known collectively as the electromagnet spectrum. These rays have several things in common: They all travel in straight lines and at the same speed (186,264 miles per second), they are not affected by electric or magnetic fields and, the shorter wave lengths at least, all affect a photographic plate. These rays, which include radio waves, infra-red light, visible light, ultraviolet light, as well as x-rays and gamma rays, differ in only one fundamental manner, and that is in wave length. All other physical differences noted are dependent upon this difference in wave length.

As the wave length becomes shorter, these rays will penetrate greater thicknesses of material, as fewer rays will be absorbed while passing through the material. The production of a radiograph depends entirely upon this differential absorbtion of the rays. The rays passing through a thick portion of the casting will be absorbed to a greater degree than those passing through thin portions of the test piece. Thick or dense portions will, therefore, appear as light areas on the radiograph, and thin, or less dense portions, will appear as dark areas. This effect can be illustrated most effectively by examining a few samples which have been radiographed, and then sectioned so that the discontinuities are revealed.

Radiography, like all testing methods, has its limitations. It will not reveal any defects, the depth of which is less than 2 per cent of the total thickness. Nor can it be depended upon to show fine porosity in all cases. The greatest use of radiography at the present time is as an inspection medium. This is unfortunate, for its greatest field is that of a production tool which will assist in correcting manufacturing faults, and thus the production of better products.

The next meeting of the group will be held at the Engineers' club on Friday, Jan. 13. V. T. Malcolm, Chapman Valve Co., Indian Orchard, Mass., will speak on "Alloy Steel Castings."—*J. T. Fegley, chairman publicity committee.*

Quad City

THE November meeting of the Quad-City chapter of the A.F.A. was held at the Fort Armstrong hotel, Rock Island, Ill., Monday evening, Nov. 21. This was one of the best attended meetings of the chapter, 105 members and guests attending the dinner and 50 more coming for the technical meeting. M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill., and chairman of the chapter, presided.

Brief reports giving information as to the progress made in the regional conferences at Iowa City were made by Horace Deane and A. V. O'Brien, members of the Iowa conference committee.

C. E. Hoyt, executive vice president of the A.F.A. was introduced to the group and spoke on the work being done by the association throughout the country.

Hyman Bornstein, past president of the A.F.A., introduced the present president of the association, Marshall Post, vice president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., who spoke on "Castings by the Randupson Process." Mr. Post introduced the topic with a brief history of the foundry industry in the district from which he came, showing the large strides made in the foundry industry. The Randupson process was clearly explained in his talk and was illustrated by pictures. Features of that process of molding, sometimes known as the cement process, were given as: Reduction of needed equipment; little change in the field in which it can be used; and patterns for the molds. Other points of advantage were that castings have clean surfaces without fins, and the castings are accurate, needing but little machining.

The session was of real interest to foundrymen as shown by the many questions asked during the period of discussion following the talk.

About 90 members and visitors heard an interesting discussion on foundry costs at the December meeting of the Quad-City Chapter of A. F. A., Dec. 19, at the Blackhawk hotel, Davenport, Ia. Chairman M. J. Gregory, Caterpillar Tractor Co., Peoria, opened the meeting with a brief reference to the work carried on by the various chapters of the A. F. A. in the United

(*Continued on page* 68)

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make every crane a bucket crane. It is simplicity itself: you turn your ordinary crane into a bucket crane by throwing the hook block of the bucket over the hook of the crane, and going to work. Brosius single hook grab buckets trip by hand line, either from the operator's cage or from the ground, and they open without shock to the crane or to the bucket. In construction they are extremely simple: the latching mechanism consists of a single guide lever, a latch, and a trip lever.

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pay dividends in safety as well as in efficiency. In mills, industrial plants and foundries where the old type of contractor's buckets have been, and are being used, too many accidents have been traced to hand dumping. Brosius automatic dump buckets eliminate the necessity of having a man stationed at the dumping point, because the buckets are handled entirely by the crane-man and cannot be unlatched in mid-air.

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(*Continued from page 66*)

States. Chris Oberlander entertained the meeting with several amusing impersonations.

The main topic for the meeting, "Cost Plus Profit Equals Price," was presented by Frank C. Rutz, vice president in charge of sales, Gunite Foundries Corp., Rockford, Ill. He substituted for D. P. Forbes, president of the same company, restrained by illness from attending the meeting. Importance of foundry cost systems was stressed by the speaker for the successful operation of a foundry. Costs, reasonable selling price and profit are the most important items. He presented many concrete examples to illustrate methods employed in determining costs in advance. Basic factors in cost systems were described with additional information on how to determine a suitable profit for manufacturing the castings. Skilled and steady men were referred to as an important factor in cost reduction. They increased production and required less supervision. The speaker considered in detail many of the cost factors that are fairly standard, clerical, getting patterns ready for the foundry, finishing the castings, shipping, etc. Next chapter meeting is scheduled for Jan. 16 at the LeClaire hotel, Moline, Ill.—*J. Morgan Johnson, secretary-treasurer.*

Wisconsin

REGULAR meeting of the Wisconsin chapter of A.F.A. was held at the Schroeder hotel, Milwaukee, on Nov. 18 with Roy M. Jacobs, chairman of the chapter, presiding.

One hundred twenty-five members and guests heard Marshall Post, president of A.F.A. and vice president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., describe the Randupson process of air dried molding and core making. The paper was illustrated with slides and motion pictures which showed the practical working of the process. A question and answer discussion followed the presentation. C. E. Hoyt, executive vice president of A.F.A. greeted the chapter and offered congratulations on its splendid program.

Details were discussed and a program outlined for the annual conference to be held in Milwaukee, Feb. 16 and 17 by the Wisconsin chapter in conjunction with the University of Wisconsin. A number of outstanding discussion leaders will be in charge of sessions on gray iron, malleable, steel and nonferrous castings. Charles Wesley, is chairman of the foundry conference committee.

Annual Christmas stag party of the Wisconsin Chapter of A. F. A. was held Dec. 16 in the Crystal ballroom at the Schroeder hotel, Milwaukee. The meeting was in charge of Roy M. Jacobs, president, and Harry R. Donald, chairman of the Christmas Party. Approximately 476 members and guests were present at the dinner and the meeting was acknowledged the largest and most successful of its type ever sponsored by the Wisconsin Chapter.

The next regular meeting of the Wisconsin chapter will be held Jan. 20 at Milwaukee and will be in charge of the Dust Hazards committee, featuring a program "Health and Safety."—*B. D. Claffey, secretary.*

To Hold Regional At Milwaukee

Plans and arrangements for the second annual regional foundry conference to be held in Milwaukee Feb. 16 and 17 under the joint sponsorship of the Wisconsin Chapter of A. F. A. and the Department of Mining and Metallurgy, University of Wisconsin, were completed recently by the committee. A tentative program has been submitted to the regional committee by Ralph S. MacPherran, Allis-Chalmers Mfg. Co., in charge of gray iron; Edward Meyer, Chain Belt Co., in charge of malleable; Dave Zuege, Sivyer Steel Castings Co. in charge of steel; Oscar Frohman of Ampco Metal Co., and B. D. Claffey, General Malleable and Werra Aluminum Corp. in charge of nonferrous. Charles I. Wesley, Wesley Steel Treating Co. and Prof. E. R. Shorey of the University of Wisconsin are co-chairman of the conference committee.

The regional conference will open at 9:00 a.m., Feb. 16, with a joint meeting in the Crystal ballroom of the Schroeder hotel, Milwaukee. The speaker will be Dean Ellis Johnson of the University of Wisconsin. The tentative program for the conference meetings follows:

Thursday, Feb. 16

10:30 a.m.—Special Sessions—Gray Iron, Malleable, Steel, and Nonferrous.
12:00 noon—Lunch and joint meeting. Subject: Flirting with New Patterns, by L. W. Rogers, College of City of New York.
1:30 p.m.—Special Sessions—Gray Iron, Malleable, Steel, and Nonferrous.
3:30 p.m.—Joint meeting. Subject: Job Evaluation by Charles Pendock, Le Roi Co., Milwaukee.
6:30 p.m.—Conference Dinner and Regular Chapter Meeting. Speaker—William Beard, Atlanta, Ga.

Friday, Feb. 17

9:00 a.m.—Special Sessions—Gray Iron, Malleable, Steel, and Nonferrous.
10:30 a.m.—Special Sessions—Gray Iron, Malleable, Steel, and Nonferrous.
12:00 noon—Lunch and Joint Meeting. Speaker—Representative of University of Wisconsin.
1:30 p.m.—Joint Meeting. Speaker—M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill.
3:30 p.m.—Special Sessions—Gray Iron, Malleable, Steel, and Nonferrous.

Chicago Will Hold Lecture Course

Chicago Chapter of A.F.A. has announced the 1939 foundry lecture course offered for operating foundrymen, apprentices and students desirous of broadening their vision and knowledge of general foundry problems.

Lectures are scheduled for selected Monday evenings which do not conflict with regular chapter meetings, and will be held in the Peoples Gas building auditorium, 122 South Michigan avenue. Cost for the complete course of lectures, including plant visitations, is $1 for members and $2 for nonmembers. A charge of 50 cents per lecture will be made for those not enrolled in the course.

The committee has prepared a program which does not duplicate the subject matter covered by the 1938 course. The subjects of the lectures are: "Melting Raw Materials", by Garnett P. Phillips, International Harvester Co., Jan. 16; "Molding Raw Materials," by Harold W. Johnson, Greenlee Foundry Co., Feb. 6; "Pattern Making and Design," by A. W. Gleason, Carnegie-Illinois Steel Corp., Feb. 20; "Modern Molding Methods and Equipment in the Production of Castings," by A. W. Weston, Chicago Hardware Foundry Co., March 6; "Melting Practices, Gray Iron, Malleable and Steel," by H. K. Briggs, Western Foundry Co., who will act as gray iron and malleable chairman, and L. F. Lottier, Peoples Gas Light & Coke Co., who will serve as steel chairman, March 20; and "Cleaning Methods," by H. L. Henniger Jr., International Harvester Co., April 3.

A plant visitation to Wisconsin Steel Co. is scheduled for April 22, while the destination for a similar trip on April 12 will be announced later.

Book Review

Creep Data, cloth, 900 pages, published by the American Society of Mechanical Engineers, New York, and supplied by THE FOUNDRY for $12 and in Europe by the Penton Publishing Co., Ltd., London.

Creep data on wrought and cast carbon and alloy steels including stainless steel, cast iron and some nonferrous metals, is presented in this publication. The data has been provided to the joint A.S.T.M.—A.S.M.E. research committee on effect of temperature on properties of metals. The information has been co-ordinated with published data assembled by the committee. The text includes 430 sheets of test data, 270 graphs and 73 tables.

Meets Exacting Conditions

(*Continued from page* 24)

of exposed and internal pin holes, gas pockets, etc. Pouring practice, particularly with the higher alloys, is extremely important, especially as related to temperatures, to prevent cold shuts, wrinkles, laps and kindred defects. Fettling and cleaning practices must be set up and adhered to carefully.

Most of the alloys are extremely sensitive to air hardening, and susceptible to cracking if subjected to intense local heating caused by burning heads and gates, hard grinding, etc. Heat treatment is of prime importance. Physical properties at room, high and low temperatures almost entirely are dependent on it. Corrosion and erosion resistance are influenced to a great degree. Aside from its effect on tensile properties, hardness is of great importance in header boxes and return bends assembled in the coil by rolled joints. The header must retain its serrations and true size without distortion during the rolling of the tubes.

Major oil companies have developed extensive and detailed specifications to cover the manufacture of oil refinery fittings. They maintain large and active field forces to inspect the fittings while in process of manufacture to insure explicit compliance with specifications. Many of the provisions may seem unjustly severe when viewed in the light of generally accepted steel foundry practice, but when considered from the standpoint of service requirements and safety, specifications or inspection standards cannot be too thorough if the customer will pay for the necessarily higher cost of compliance therewith.

Obviously, foundry practices resulting from the necessity of complying with severe restrictions will be much more costly, more involved or detailed, and generally much more refined than those normally employed in the production of ordinary carbon or low alloy content commercial steel castings. Appreciating that the manufacture of pressure fittings is highly specialized branch of the foundry industry, the Key Co., in July, 1938, completed and placed in operation one of the most modern steel foundries in existence. The Conover Engineering Co., Cleveland, in collaboration with the engineering and executive staff of the company designed the new plant especially for the production of Key cast steel fittings. The present plant represents the sixth and largest building and development program since the company started to manufacture fittings and specialties for abnormal pressure and temperature applications in 1914.

Table II

Minimums for Test Specimens

Property	Specimens from Test Blocks 1-1½ Inches	2-2½ Inches	3-3½ Inches	Specimens Cut from Castings
Yield Point, pounds per square inch	80,000	75,000	70,000	75,000
Tensile strength, pounds per square inch	110,000	100,000	90,000	100,000
Elongation, per cent in 2 inches	16.50	15.00	14.00	11.00
Reduction of area per cent	30.00	28.00	25.00	18.00
Brinell hardness range	180-220	180-220	180-220	180-220

Well Supplied with Cranes

In the accompanying illustrations Fig. 6 shows the roofed raw materials storage yard, served by a railroad siding and a 3-ton overhead traveling crane made by Shepard-Niles Crane & Hoist Co., Montour Falls, N. Y. The crane is equipped with a grab bucket and lifting magnet. That company also supplied four other overhead electric traveling cranes for service within the plant.

The foundry section of the building 125 x 240 feet is divided into two main bays. One bay houses the furnace, molding, coremaking, sand handling and sand preparation departments. Molds are cored, closed, poured and shaken out in the second bay. Cleaning, heat treating and finishing departments occupy about 20,000 square feet of floor area.

Orderly straight line flow of materials from stock pile to finished casting is mandatory with the type of plan layout. Ventilation and light were given full consideration in the design. Twenty complete air changes per hour are provided by 32 power driven ventilators built into the roof by the H. H. Robertson Co., Pittsburgh. About 30 per cent of the roof area is single pitch skylight, which insures an unusual distribution of light over the entire shop floor, and a light intensity that compares favorably with daylight on the outside.

Shape and arrangement of the roof with the peaks extending across the building as shown in Fig. 6, has a decided tendency to localize smoke and minimize the tendency for it to drift the length of the building, irrespective of the direction in which the wind may be blowing. An interconnected series of cat walks located below the roof facilitates servicing the lights, skylights and ventilators.

All dust producing operations are hooded and exhausted to maintain clean and healthful conditions. This feature is taken care of by three dust collection units supplied by the American Air Filter Co., Louisville, Ky. Dust is collected and disposed of as a wet sludge. Exhausted air is discharged outside the building. Tumbling mill and grinders are connected to a unit with an exhausting capacity of 8000 cubic feet per minute. The 10 x 12 foot sandblast room is served by a second unit which handles 15,000 cubic feet of air per minute. A third and larger unit with a capacity of 18,000 cubic feet of air per minute is connected to the shakeout and sand handling system.

Artificial light is provided by a 50-50 combination of mazda and mer-

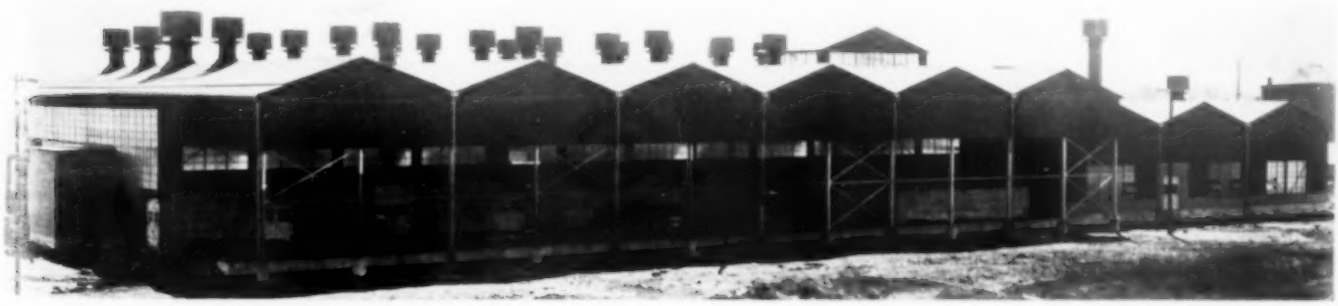


Fig. 6—Extension of roofs on founry buildings provides ample space for protection of stored materials against the weather

cury vapor lamps attached to the lower chords of the roof trusses, spaced alternately and equally on 20-foot centers. This arrangement provides an even distribution of light at the working level, with unusual penerating power and nearly normal color perception.

The foundry building is a completely integrated unit. Adequate space is provided for all auxiliary departments, chemical and physical laboratory, inspection laboratory, time office, first aid room, locker rooms, pattern shop, pattern storage, production control office, foundry engineering office and others.

Adventures of Bill

(*Concluded from page* 58)

dition would be fagged if he attempted to follow you through that miscellaneous trail through bell land. If you intend to plunge any deeper into the underbrush, you can count me out. And please do not drag in the sleigh bells. Snug and warm by the old fireside I can listen with pleasure to the merry tinkle, or at least I could in the days and nights before sleigh bells were ousted by the blaring auto horns, but I want no part of sitting in a sleigh, slowly congealing into a ball of ice, while trying to coax something better than 3 miles an hour out of a livery plug."

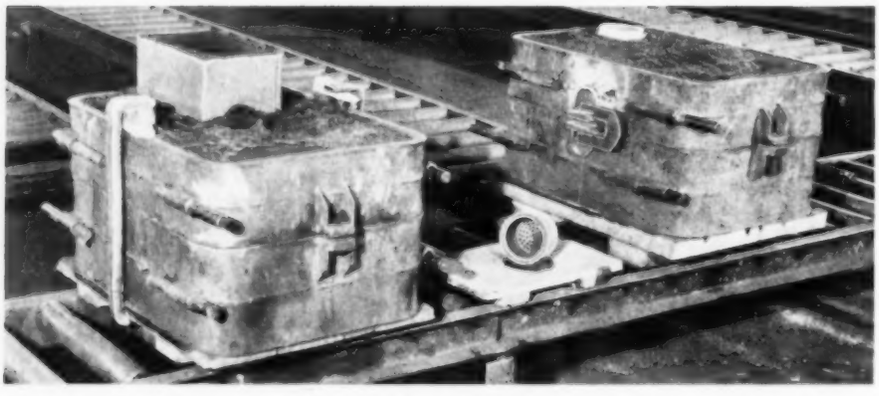
"You must have been alone," Bill commented, "or what amounts to the same thing, the girl was scrooged over against the port side of the cutter and wondering why she ever had been silly enough to go out riding with you.

"However, if the sleigh bells arouse no pleasant memories, you certainly should be able to work up a little enthusiasm over silver bells and cockle shells and pretty maids all in a row. How about school bells, telephone bells, dining room bells, front door bells, cash register bells and the jangling little bell over Miss Tupper's door which warned her that a cash customer was on the premises ready and willing to exchange a small amount of the coin of the realm for a licorice stick, half a dozen bull's eyes or a hunk of sticky molasses taffy. Intervals between customers were spent by the aged lady in a back room where she cooked up further supplies of the sticky, odorous, but highly satisfying molasses and butter combination. She was very fond of little boys and had the greatest faith in their honesty and integrity, but she also was aware of human frailty and she prudently decided that her presence in the front shop would serve as a major factor in enabling the small boy to resist temptation. When the bell rang over the door, she was Johnny on the spot, or in the modern phrase she was there with bells on." The old eye might not stop a charging leopard but it petrified the political young lifter standing on the middle of the floor. Many a boy had his first conviction that honesty is the best policy in that old shop.

"Tell the rest of the story to Victoria," I said, "She may be interested in bell boys, bell buoys, belle lettres, bell wethers, diving bells, blast furnace bells, the belle of the ball and dumb bells."

"Ah!" Bill sighed, "If we had no ladies present—your servant Victoria, ma'am—I certainly could go to town on that last item."

New Method of Clamping Flasks



ILLUSTRATING the old and the new method of clamping flasks and making up runner basins, part of a rejuvenating and mechanized program recently adopted in a prominent gray iron foundry in the East. The U-clamp fitting snugly on the slightly tapered lugs on the side of the flask takes the place of the long, unwieldy clamp, block and wedge. The green sand runner basin subject to erosion from the falling metal stream, has been replaced by a dry sand cup provided with a strainer in the bottom. The cup fits easily and securely in a suitable cavity on top of the cope. Illustration courtesy Otis Elevator Co., Yonkers, N. Y.

Malleable Founders Hold Meeting

The semiannual meeting of the Malleable Founders' society was held in the Terminal club, Cleveland, on Thursday, Dec. 15. Principal features of the program included reports on the various activities of the society and a talk, "Relationship between Buyer and Seller," by Thomas D. Jolly, director of purchases, Aluminum Co. of America.

The morning session, Prof. Enrique Touceda discussed, "Relationship between Chemical Composition, Annealing Cycle, Tensile Properties, and Carbon Nodule Distribution," "Results of Fluidity Tests," and "Comments on recent paper on Melting and Annealing by A. L. Boegehold." James H. Lansing, shop practice engineer, reported on shop practice activities and Leon J. Wise, Chicago Malleable Castings, discussed the special research projects of the society. John A. Wagner, president, Wagner Malleable Iron Co., Decatur, Ill. and chairman of the cost committee, reported on "Cost Estimating; Proposed Cost Manual Revisions."

In the afternoon Robert E. Belt, secretary of the society, discussed "Plants and Capacity Determinations" and Anthony Haswell, Dayton Malleable Iron Co., Dayton, O., presented some illustrations of job evaluation. Mr. Belt reviewed the highlights of the annual meeting of the National Association of Manufacturers held recently in New York and R. R. Fauntleroy, president, Moline Malleable Iron Co., St. Charles, Ill., reported on federal legislation and especially the wages and hours law. Charles S. Anderson, Belle City Malleable Iron Co., Racine, Wis., reported on, "Product Promotional and Publicity." Frank O. Parker, Acme Steel & Malleable Iron Works, Buffalo, and president of the society, presided.

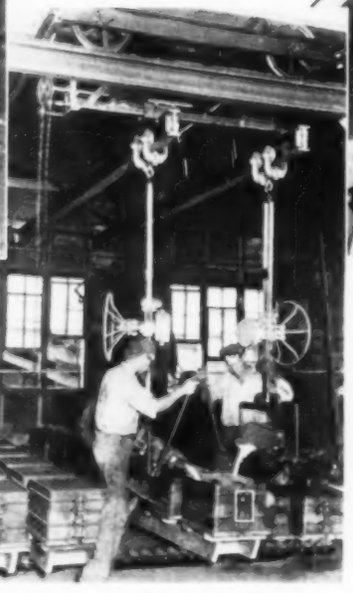
Purchases Electric Furnace Firm

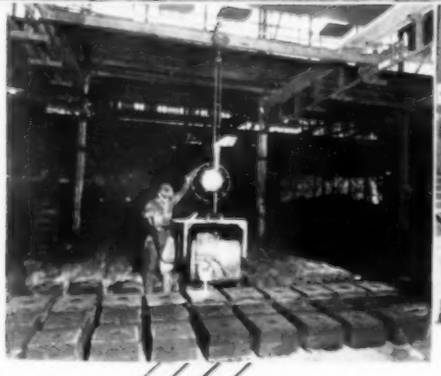
Kuhlman Electric Co., Bay City, Mich., has purchased the Detroit Electric Furnace Co., Detroit, and will operate that organization as the Detroit Electric Furnace division of Kuhlman Electric Co. with headquarters at Bay City. There will be no interruption in the servicing of Detroit furnaces and the same sales, service and production personnel, which has been with the company for many years, will continue under the direction of A. E. Rhoads. The Kuhlman company is among the pioneers in building electric furnace transformers.

APPLY *Modern* EQUIPMENT *in your foundry!*

MODERN Enclosed Elongated Mixing Ladles produce uniformity of metal and permit metal refining in the ladle. Metal temperatures maintained three times as long as in open mixing ladles.

Mfgd. under USA Patents 1703231, 1816185, 2073150, 2079765, 2122032, 2100713, 2134785, others applied for





MODERN One Man Pouring Devices

MODERN Covered and Insulated Ladles enable handling larger amounts of metal with less heat loss.

The MODERN RICHARDSON Cupola Charger reduces charging and melting costs to a minimum.

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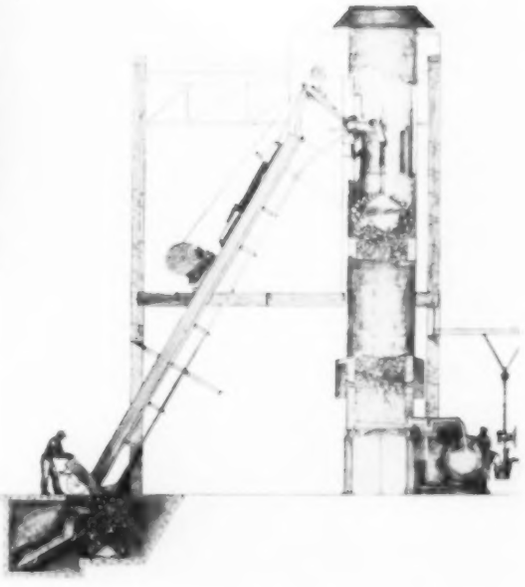


MODERN EQUIPMENT COMPANY

DEPT. 150
PORT WASHINGTON, WIS.

MODERN EQUIPMENT CO.

Iron of the proper composition for the casting gives a fine finish

Low Carbon Iron

(*Concluded from page* 29)

Because low carbon iron is dense, more friction is generated during the machine operation. Some men hold to the opinion that lower speeds, heavier feeds and tools with more body and less rake is the approach to better machining time.

As users of castings become better acquainted with these irons they complain less. The time perhaps is not far distant when machine shops will realize that they have a job to do to keep in step. Machine tool design and tool steels are improving rapidly, and this is a material help.

For certain castings there is a wide difference of opinion whether a slightly open grain is better than a close, dense structure. Machine beds illustrate this point. Proponents of the open grain claim that the metal holds the oil film better under heavy loads. This is a question for the engineers to answer. The foundryman's job is to make what they ask for.

Probably the most common source of complaint is hard corners and edges, especially where milling is the method of machining employed. Usually the iron is not proper for the job, or it has become chilled. There is also the possibility that the pouring temperature has been too low, or that the method of gating should be changed.

Small castings frequently have very light lugs or ears. Perhaps part of the casting is fairly heavy. Chances are that it will be gated on the heavy part. When the metal runs up into the ears it cools quickly because the body of iron is small compared with the large body of cold sand. The result is a tendency toward higher combined carbon in the section where it is not wanted.

If the casting could be gated on the ears the sand would become heated while the heavier section is being filled. The hot sand retards the cooling, which tends to reduce the combined carbon. Perhaps the ears are so light that to gate in them is not practical, since they may break when the gate is removed. As an alternative a false gate can be carried around the ears, to heat the sand before they fill. Such a false gate, or heater, as it would be called in this case, frequently is a help.

It is conceded quite generally that the use of a mixing ladle of sufficient size to hold three charges is an important factor in producing castings of uniform analysis. A casting poured from both ends will have a different grain structure at each end, unless the iron in both ladles is of nearly the same temperature. When two ladles are filled at the same time under two cupolas there is no problem. However, when they are filled from the same cupola it is different. The temperature can be evened up by filling one ladle half full, then taking it out and filling the other, and then putting the first ladle back.

Importance of filling a mold with iron of as uniform temperature as possible often is recognized. Some foundrymen now are pouring with two ladles where formerly only one was used. Speed of pouring also is a factor. The smaller the spread in temperature between the different parts of the mold the less severe the internal strains.

Eliminate the Variables

A foundry presents a large number of variables. Still, a uniform product must be produced. Therefore it is desirable to eliminate as many as possible of these variables.

Head pressure is quite important with low carbon irons. Deeper copes and higher risers help to overcome both internal and external shrinkage. The fact that pressure is desirable is one reason why dry sand molds are a help. A mold that strains tends to offset the benefits of head pressure.

Foundrymen should try to influence engineers to designs with uniform metal section in mind. Progress along this line will benefit all concerned, including the machine itself. Sharp corners and right angles often are the cause of serious trouble.

A wheel with an unequal number of arms may not crack, while a wheel with an even number of arms may. When locomotives used cast iron wheels the foundryman had a problem which gave him constant worry. He felt better when he could make a wheel with an uneven number of arms, because in such a wheel there is no direct pull as there are no arms directly facing each other. The same principle applies to ribbed castings, such as a round casting with ribs running to a central hub.

Few foundries are equipped to handle every job successfully. There is a growing tendency to recognize this fact in considering new work. Many successful jobbing shops have placed a limit on type, size, and weight of castings. Often a foundryman determines this limit by the capacity of his cranes. This, of course, may be an important factor, although it is not the whole story.

Other factors worthy of consideration are: (a) Has he experience with this type of work, and are his molders capable of handling it satisfactorily. (b) Has he the proper rigging for the job. (c) Does he have the right sands and gravels. (d) Should the job be made in dry sand, and if so, has he oven capacity for drying. (e) How are the core shop facilities. (f) Can he produce the right kind of iron. (g) Can the job be properly cleaned. (h) Has he sufficient experience with this type of work to price it properly. (i) Can he suffer more than a normal loss for the shop and still make a profit?

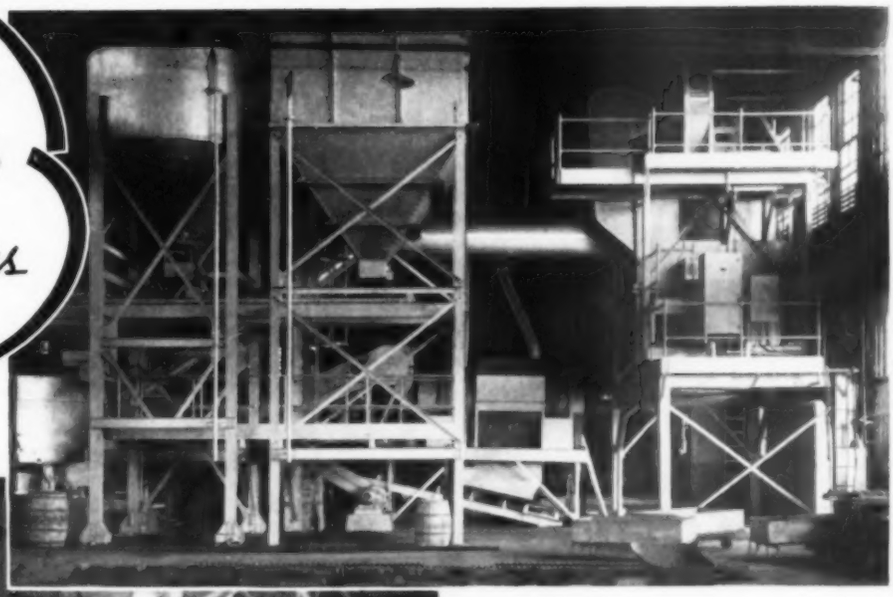
Causes Much Trouble

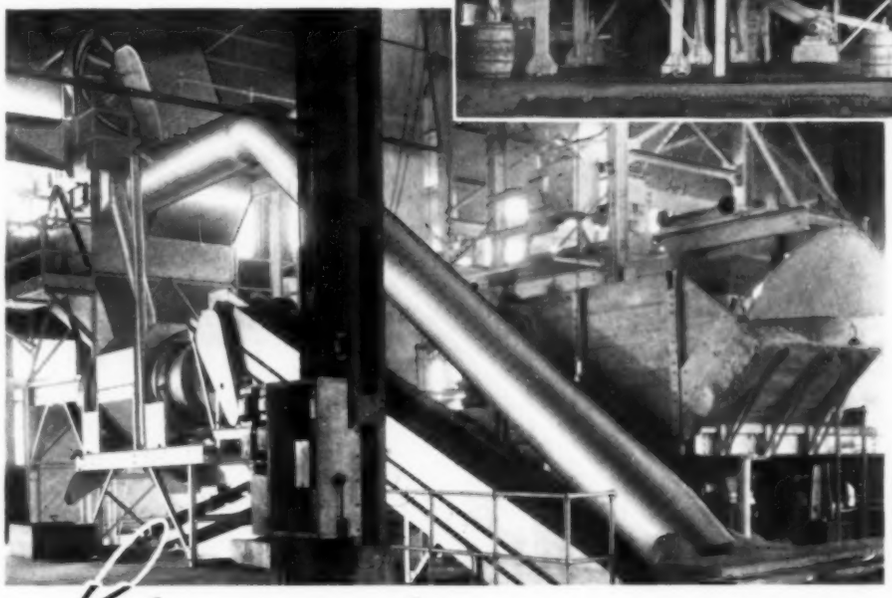
One of two things often happens when a foundryman bids on a job that does not fit his shop or his experience. He either bids so high that he does not get the job, or he bids so low that he has to take a loss. Perhaps the most serious consequence of this is the effect it has on the industry as a whole. This and inefficient cost systems are responsible for a condition which should not exist in an industry where so much ingenuity, experience, and ability are required to convert raw materials into a commercial product.

A new and strange job will present plenty of problems even to the shop that has all the required facilities. If, in addition to these legitimate problems the foundryman has to stumble along without the proper facilities he would be much better off if his better equipped neighbor had the job. Adoption of orphans is most prevalent in dull times.

It appears to be the safer policy to examine every new prospect carefully before making a bid. There are of course jobs that have to be taken as a matter of policy. These are not referred to here. A foundryman cannot always pick and choose his work. If he did, he would soon go out of business. But certain jobs definitely should be left alone.

Submit your dust problems to **AAF** *Engineers*





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In applying Roto-Clone to hundreds of foundry dust problems, the AAF engineers have compiled a wealth of information on the control of dust that is available to you without cost or obligation. Write for Bulletin No. 274.

AMERICAN AIR FILTER CO., INC.
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116 Central Ave., Louisville, Ky.

● The Type W Roto-Clone is a single compact self-contained unit, which may be located inside the foundry building at or near the source of the dust. Its design requires minimum floor space, and eliminates fans, pumps, tanks or other auxiliary equipment. Made in a wide range of capacities to meet every foundry exhaust requirement including shakeouts, sand handling, conditioning screens, mullers, tumbling mills, sand blast, grinders, etc.

TYPE W

ROTO-CLONE
For Foundry Dust Control

Nonferrous Foundry Alloys

(*Concluded from page* 32)

cent. Presence of iron also tends to influence the blackening of the surface and, therefore, should be kept at a low point if the castings are to exhibit a bright red color for some specific purpose, such as valves or name plates, etc.

Pouring temperature listed for these alloys is given for average work. Where the castings are extremely thin and possess a large surface, the maximum specified may even be found too low, although pouring at a temperature above 2300 degrees will be found to cause other worries. Therefore, it is better to provide gating that will enable the production of castings without pouring at an excessively high temperature.

Compositions *M* to *P* comprise a series of yellow brasses containing no lead or tin or aluminum with the exception of *O*, which requires 1 per cent tin, but no lead or aluminum is permitted. Composition *M* is used commonly for flanges or saddles where color is important, and since it has no lead present it does give some trouble if accurate machining is desired. Composition *N* is a yellow brass used for ornamental castings, bolts, and hinges, and is somewhat more distinctly yellow than composition *M*.

Composition *O* is commonly known as naval brass, and is covered by specifications QQB 691, alloy *A*, by the Federal Specification board. It is used often as cast brass that must match in color, tubing or rod produced in rolling mills, and on shipboard is commonly used to from the necessary fitting for brass railings, etc.

However, it has frequently been the practice of those who make these parts for attachment to tubing or rod, are desirous of matching the color and also of making the parts as cheaply as possible, and consequently must machine them rapidly, to add a small proportion of lead so that machining speeds may be increased. Such alloys are covered in the compositions *T* to *AA*.

Composition *P* is a high zinc, yellow brass, known as muntz metal. The color of muntz metal tubing as it comes from the rolling mills can be best matched by muntz metal castings. Where the tubing or rod is made from alloys carrying a higher percentage of copper and a lower percentage of zinc the castings in order to match them should be made from a close approximation of the same proportions of these elements, with a small percentage, say 0.5 per cent lead permitted to facilitate the speed of machine work.

This is the first part of a discussion on metal compositions available to the nonferrous foundryman. The second part will appear in the February issue.

THE EDITORS

Publish Standards

Compressed Air institute, 90 West street, New York, has published a 110-page book containing the trade standards which it has adopted. This is the fifth edition of the book, and it is divided into two main sections. The first covers definitions; nomenclature; rating standards, guarantees, trade policies; test standards: installation and care of compressors; lubrication; tables, and uses of compressed air. The second relates to reciprocating compressors and vacuum pumps; rotary displacement compressors, blowers and vacuum pumps; centrifugal compressors and blowers; compressor accessories; portable compressors; rock drills and accessories. and pneumatic tools and accessories. Price of the book is $1.

Succeeds Firm

Barium & Chemicals Inc., Willoughby, O., has succeeded the J. H. R. Products Co., Willoughby. Dr. M. J. Rentschler, director of research of the latter company since its inception will continue in the same capacity with Barium & Chemicals, Inc. Norman Stern is president of the company.

Annual show of the Purchasing Agents association of Indianapolis will be held Feb. 14-17 at the Manufacturers building, Indiana state fair grounds, Indianapolis.

Table II

Physical Properties of Various Nonferrous Alloys

No.	tensile strength	Yield point	Elongation per cent	Compression of 0.001 inch.	Compression Inches at 100,000 lb. sq. in.	Brinell Hardness	Weight pounds per cu. in.
A	32,000	110,000	39			49	0.312
B	30,000-39,000	15,000-18,000	25-40	10,000-12,000	0.35-0.38	45-50	0.314
C	38,000	20,000	25			60	0.314
D	35,000-45,000	16,000-18,000	20-25	12,000-13,000	0.32-0.36	44-48	0.310
E	25,000		12				
F	29,000-35,000	12,000-16,000	25-35			40-50	0.314
G	29,000	17,900	16			57	
H	36,500	12,000	22				0.315
I	28,000	12,000	15-20			50-60	0.312
J	31,000-37,000	-	25-35			50-60	0.310
K	25,000-30,000		15-25			45-55	0.312
L	28,000		15				
M	35,000		31				
N	40,000		35			37	0.305
O	30,000	15,700	15				
P	45,800	21,800	15			22	0.300
Q							
R							
S							
T	28,900	16,100	19				
U	30,000-36,000	9,000-10,000	28-36			44-50	0.314
V	30,000-35,000		35-45			40-50	0.305
W	29,000	10,500	25			53	0.303
X	28,000-33,000	9,000-11,000	25-32			40-50	0.302
Y	30,000-35,000	13,000	25-35			40-50	0.300
Z	20,000		15				
AA	30,000-45,000		15-25			40-50	0.295
BB	105,000-120,000	65,000-75,000	7-15			240-270	0.282
CC	70,000-75,000		22-30			109-119	0.302
DD	65,000 min.		20			130	0.300

Note: Where physical properties are omitted for any particular composition, this indicates that the information is not available at this time. It is hoped that in future publications of these tables as revised, these omissions will be corrected.

What Is Advertising?*

A LONG time ago there was no advertising. Every man with something to sell had to tell people about it personally and individually. This was not a great handicap in those days, for no one had very much to sell.

But as soon as large-scale manufacturing was begun, it was necessary to find a way to tell many people about products, and to tell them quickly and all at one time. To fill this need, advertising naturally developed as a universal business process. Without it we could not operate large factories making goods for millions of consumers.

Advertising is sometimes spoken of as a special kind of business, as a separate industry supported by other lines of business. It is no such thing at all. Advertising is simply a part of the process of selling the products of every industry. It does the important job of telling people about merchandise and where to buy it, and it stimulates their desire to buy.

It is not enough to make goods and to transport them to places where consumers can buy them. The public must be told about the goods—how desirable they are, how people can make themselves more comfortable, more healthy, or more happy through buying them. In other words, the merchandise must be sold, not merely placed on sale. Advertising does a large part of this selling, and there is no other method that can take its place.

Since the days when there was no advertising, the quantity of goods produced has been multiplied by many, many times. Consequently each consumer's share is vastly increased. The wealth created in making the goods is distributed to consumers through payments for wages, materials, and dividends, and thus they are able to buy the greater volume of goods produced.

But merely being able to buy does not make people buy. Salesmen and advertising must be kept on the job all the time, to keep merchandise moving from factory to consumer, or the wheels will soon stop turning. The work of selling is just as important as the work of making and the work of transporting. And advertising is the only way by which the large volume of goods now being produced can be sold.

In performing its selling work, advertising shows us the way to better living, by creating desires for better things. Through conveniences introduced by advertising, the burdens of housekeeping have been made easier and the family diet has been improved. Babies are healthier and homes are more sanitary because of the educational influence of advertising. Newspapers and magazines are sold for a few cents a copy and radio entertainment is free, because advertisers pay most of the costs of these three great mediums for advertising.

While doing all this useful and valuable work, advertising costs the consumer nothing because it is the most economical form of selling and lowers the cost of distribution. Advertising is the voice of industry, telling us all how to live happier lives and how to make our money go farther.

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—Advertisement

Cracks In Chill Rolls

(*Concluded from page* 35)

roll is cast in a chill, and although the face is not chilled, the roll is strong and shows good wearing properties. For the size given the following analysis is suitable: Silicon 1.40 per cent; sulphur 0.06 per cent; phosphorus 0.40 per cent; manganese 0.45 per cent; chromium 1.00 per cent; nickel 1.75 per cent; total carbon 3.15 per cent.

These small rolls are left in the chills for 18 to 24 hours. Grooves on the inside of the chills merely represent unnecessary expense. They are of no practical benefit in their theoretical purpose of controlling or affecting uniformity or depth of chill. Composition of the iron takes care of that feature. As shown in Fig. 1, metal is poured through a long sprue 2½ inches diameter at the top, 2¼ inches at the bottom and enters the lower neck of the roll through a rectangular gate 2 inches high and ⅞-inch wide. General features of flask and chill also table of standard dimensions for various sizes are shown in Fig. 2.

Difficulties Are Experienced

On the subject of cracks in chilled rolls *D* readily can imagine the difficulties experienced in attempting to make chilled iron and alloy chilled iron rolls from a low carbon semisteel mixture melted in the cupola. In American practice this type of roll metal is melted in the air furnace, while the cupola is employed only for melting metal for hard faced carbon rolls. Steel in the mixture increases shrinkage in the casting, again increased by the high temperature of the melting process. Both of these factors tend to cause cracks in the body and necks.

For the size of rolls in question the thickness of the chills is correct, but it is entirely unnecessary to machine grooves in the bore. All rolls should be bottom poured through a tangential gate. This represents universal practice both here and abroad. In the present instance the sprue should be approximately 3 inches diameter at the top. At the point where the gate is attached to the neck of the roll the opening should be choked to an oval shape about 1 x 1½ inches. This form of gate imparts a high velocity whirl to the metal as it rises in the chill and prevents the formation of wrinkles.

The chill should be coated with a good roll blacking. In American roll practice this coating material is a mixture containing 90 per cent finely pulverized 72-hour coke and 10 per cent good refractory plastic clay. Usually it is purchased in prepared form from certain foundry supply houses. Incidentally it is interesting to note that several European roll makers have abandoned the use of graphite mixtures and now are buying their roll blacking in the United States.

Melting and casting temperatures are exceedingly important factors in roll making. If the metal is poured too hot, the casting will develop hot tear cracks on the body and necks. If the metal is too cold, pin holes and chill balls will appear on the body. Also the casting probably will contain fine cold cracks extending all the way through the body. Casting temperature should be close to 2450 degrees Fahr. as measured by an optical pyrometer and corrected to actual temperature.

Analysis Is Normal

Analysis of the metal as given in the inquiry is about normal with the exception of the manganese which is much higher than desirable. High manganese causes the mottle area to extend too far toward the center of the roll and produce an iron inclined to crack. The manganese content should be maintained below 0.30 per cent. The phosphorus content is not given. This element should be maintained between 0.35 and 0.50 per cent. Lower amount is inclined to increase shrinkage and tend toward the formation of cracks.

Based on the evidence submitted, the indications point to the melting process as the cause of the cracked castings. It is necessary to bring the semisteel mixture down hot in the cupola, and this hot melted iron is very liable to crack when it comes into contact with the chill. In standard air furnace practice the iron never is permitted to become hotter than necessary. Rolls of the size indicated should be left in the chills about 10 hours.

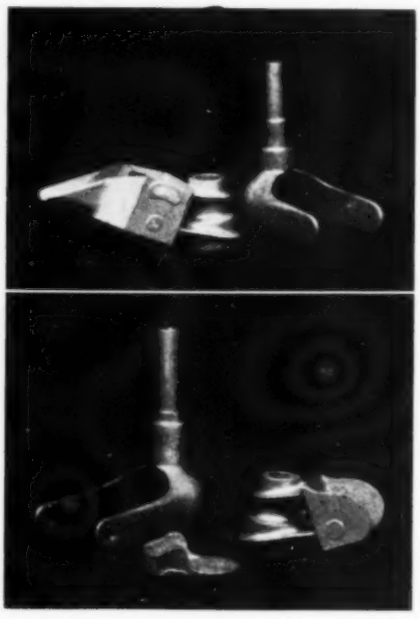
Manufacture of small rolls with a chilled depth of 2 to 2½ inches presents an exceedingly difficult problem and a great deal of cracking may be expected. These castings will be practically white to the center and inclined to split every way. They are considered impractical in American practice and have been superseded by alloy grain rolls.

Whiting Corp., Harvey, Ill., has transferred its Detroit offices from the Machinery building, 2842 East Grand boulevard, to 210 Curtis building, 2832 West Grand boulevard. Walter Hans is district manager.

Malleable Castings For Airplanes

Lancaster Malleable & Steel Casting Corp., Lancaster, N. Y., which has produced two types of aircraft tailwheel assemblies in which malleable iron is used for the first time. One of the assemblies was designed for attachment to a tail spring leaf of a Rearwin cabin monoplane and the other for attachment to the skid tube on an Aeronca cabin monoplane.

Three castings were required for the spring leaf assembly, a fork, a bracket, and an attaching plate but only a fork and bracket for the skid tube model. In the fork castings, a combination of alloys was used and after heat treatment the castings provided high strength characteristics. The bracket castings were cast and treated as normal malleable iron and provided adequate strength.



Two views of the several castings required for the tailwheel assemblies

The weight factor was important because it is estimated that every additional pound on the tail of any airship means the approximate loss of 10 pounds carrying capacity. In both types the sections were reduced in weight by the use of strengthening ribs and fillets. These assemblies tested in field service were approved by the Aeronautical branch of the department of commerce.

South Bend Lathe Works, 425 East Madison street, South Bend, Ind., recently has published the 34th edition of "How to Run a Lathe." The new edition has been completely revised and material added. Copies may be purchased from the company for 25 cents.

"CLEANBLAST"
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These bags of "Cleanblast" — The Tempered Abrasive—are on their way to prove to users our claims of faster, cleaner blasting operations.

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Sizes for all purposes:
Shot from No. 5 to No. 30
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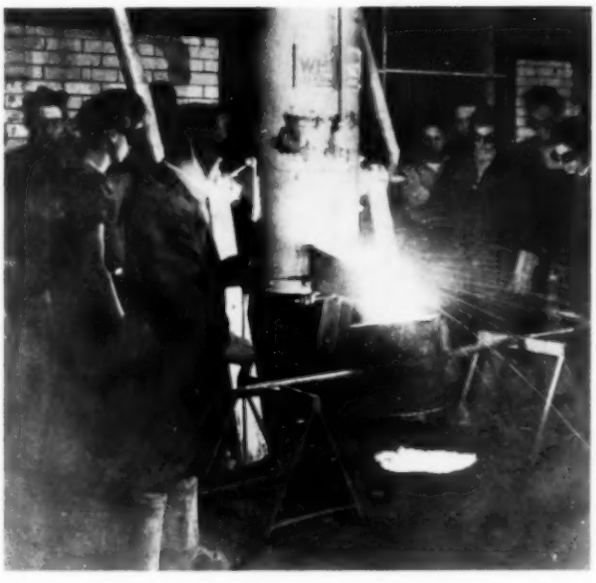

A Guide Book for the Apprentice sponsored by the National Founders Association, Chicago

This new and completely revised second edition is a text designed primarily for foundry apprentices and practical students of foundry operations. The text conforms to the requirements for instruction as set up in the minimum standards of four year foundry apprenticeship in the United States. Revised and Edited by Pat Dwyer and Edwin Bremer of The Foundry.

CONTENTS: Substances and Their Structure; Some Physical Properties; Oxidation, Reduction, and Combustion; Force and Motion; Application of Force; Mechanics and Fluids; Iron; Effects of Elements on Iron; The Cupola; Elementary Problems in Steel Foundry Practice; Foundry Sands; Gates and Risers; Molding Machines; Permanent or Long-Life Molds; Glossary; Bibliography.

375 PAGES — 132 ILLUSTRATIONS — 16 TABLES

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(*Concluded from page* 25)

POST CONGRESS TOUR

Section A of Tour

Sunday, June 18

Morning—Leave London (Paddington) at 10:10 a.m. Arrive Banbury at 12:13 p.m. Proceed by motor coach via Sulgrave manor to Leamington for luncheon.
Afternoon—Motor coach drive through Shakespeare country, Warwick, Stratford-on-Avon, Kenilworth, etc. to Birmingham; arriving about 7:00 p.m.

Monday, June 19

Morning—Works visits Birmingham area.
Afternoon—Works visits Birmingham area.
Evening—Dinner by invitation of Birmingham branch, I. B. F.

Tuesday, June 20

Morning—Works visits Birmingham area. Depart from New street station, Birmingham at 12:40 p.m.; arriving Derby at 1:33 p.m.
Afternoon—Works visits Derby area.
Evening—Proceed to Matlock. Dinner at invitation of East Midlands branch I. B. F.

Wednesday, June 21

Morning—Works visits Derby area or an all day visit to Stanton Ironworks Co. Ltd., Stanton, near Nottingham.
Afternoon—Works visits Derby area or an all day visit to Stanton Ironworks Co. Ltd., Stanton, near Nottingham.
Evening—Proceed to Sheffield. Social function by invitation of Sheffield branch I. B. F.

Thursday, June 22

Morning—Works visits Sheffield area.
Afternoon—Works visits Sheffield area.
Evening—Depart for Manchester. Informal reception in Manchester.

Friday, June 23

Morning—Works visits Manchester area.
Afternoon—Works visits Manchester area.
Evening—Dinner by invitation Lancashire branch I. B. F.

Saturday, June 24

Morning—Works visits Manchester area.
Afternoon—Visit to Chetham's Hospital (famous boys' school; fifteenth century buildings), or to John Ryland's library (rare and costly books and manuscripts). Section A of post congress ends. Those not participating in second week of tour may return to London.

Section B of Tour

Saturday, June 24

Evening—Leave Exchange station, Manchester at 5:05 p.m. arriving Oxenholme 7:05 p.m. Leave Oxenholme 7:15 p.m. arriving Windermere (English lake district) 7:42 p.m.

Sunday, June 25

Morning—Free.
Afternoon—Leave by motor coach at about 4:00 p.m. for tour of English lake district via Ambleside, Grasmere, Thirlmere, and Derwentwater to Keswick.
Evening—Leave Keswick at 6:55 p.m. arriving Glasgow at 10:46 p.m. dinner enroute.

Monday, June 26

Morning—Steamer trip down River Clyde.
Afternoon—Steamer trip down River Clyde.
Evening—Theater evening or free.

Tuesday, June 27

Morning—Works visits Glasgow area.
Afternoon—Works visits Glasgow area.
Evening—Reception.

Wednesday, June 28

Morning—Leave Central station, Glasgow 9:50 a.m., arriving Edinburgh (capital of Scotland) at 10:58 a.m. Sightseeing by motor coach.
Afternoon—Sightseeing.
Evening—Free.

Thursday, June 29

Morning—Leave Waverley station, Edinburgh at 10:15 a.m. arriving Newcastle-upon-Tyne at 12:37 p.m.
Afternoon—Works visits Newcastle-upon-Tyne area.
Evening—Dinner at invitation of Newcastle branch I. B. F.

Friday, June 30

Morning—Works visits Newcastle-upon-Tyne area.
Afternoon—Works visits Newcastle-upon-Tyne area.
Evening—Leave Newcastle-upon-Tyne at 6:33 p.m. on Coronation (one of world's fastest trains) arriving London 10:30 p.m.

Problems Should Be Solved Now

By Walter S. Lister, President
C. O. Bartlett & Snow Co., Cleveland

Every man who has attained any degree of success in life, can, in retrospect, recall the occasions when the patterns of action, which have served him well for a given period, seem to have lost their values, and he has found himself in a position corresponding to that of a traveler at a fork in the road with no guidepost. In such a circumstance, the wise man,—like the seasoned traveler,—will make investigation, before proceeding further.

Many foundrymen are today in a dilemma, not greatly different from that outlined above. Business volume is below normal; wages are at an all-time high and are tending toward higher levels; taxes,—because of debt burdens and increased cost of government,—are staggering; regulatory acts, applicable to foundries as to other industries, require executive attention to business minutia,—formerly handled by subordinates,—but which, owing to heavy penalties for nonobservance, cannot be treated lightly. All these resolve themselves into higher cost of products, and threaten to wipe out profit, which is the prime incentive.

Foundrymen, so at the fork of the road, can learn by a little inquiry how some operators of foundries—trail-blazers, truly—have solved the problems they now face. The trail so blazed, takes the right turn, and traverses terrain, the chief characteristics of which are efficiency in methods, and improved products,—both of which, when closely studied and analyzed, give promise of satisfactoriness.

Laying metaphor aside for the moment, it has been established that a well and modernly engineered plant for foundry production, when compared with hand operated methods, has a rate of production, per square foot of floor space, four times as great, and the cost of modernization can usually be met through the savings effected in from 6 months to 2 years,—depending on the volume and class of production. Even jobbing foundries, modernly equipped with efficient sand handling installations, and where service has had proper consideration, have shown savings which in 2 years have equalled the entire cost of overhauling.

Most foundries, to insure efficiency in method and improvement in product, require study from the viewpoint of the service to which such foundries have relation. Equipment to be installed should be tailor-made, so as to fit it to the particular duty, as disclosed by such study. The proper preparation of sand for any foundry, of itself involves a thorough knowledge of the possibilities of accomplishment through one or other of the various special treatments, if correct results are to be obtained.

Foundrymen, like men in other industries, and people generally,—who expect to reach any worthwhile goal,—cannot afford to stand long, in a defeatist attitude at the fork of the road.

Book Review

Third Report of the Steel Castings Research Committee, cloth, 5½ x 8½ inches, published by the Iron and Steel institute, London, England, and supplied by THE FOUNDRY, Cleveland.

This volume which in addition is designated as *Special Report No.* 23, is the most recent addition to the numerous reports published by the British Iron and Steel institute, and is the result of an extensive investigation by a joint committee of the institute and the British Iron and Steel federation. The book is divided into six sections relating to various phases of steel castings production. The first section comprises the introduction while section II discusses the fluidity of iron-carbon and other iron alloys.

Section III is concerned with copper-steel castings, and section IV describes the strength and ductility of cast steel during cooling from the liquid state in sand molds. Section V is devoted to the first report of the molding materials subcommittee, and occupies over 100 pages of the book. It deals with such phases as methods of testing molding sands, elutriation methods, compression strength of molding materials, refractoriness, synthetic molding materials, molding compositions, and new sources of molding materials. The sixth and final section contains a comprehensive bibliography embracing 94 pages.

ADVERTISING PAGES REMOVED

Table I — Chemical Requirements Grouped by Various Elements

Phosphorus-Maximum

0.05 *per cent*	0.07 *per cent*
A27-36T	QQS-681a-O
A87-36	49S11-C
A95-36	
QQS-681a-1, 2, 3, 4	
49S11-A, B, Bs, D, F	
AREA	
AAR-M201-36	

Carbon-Maximum

Not specified	0.15 to 0.45 *per cent*	0.30 *per cent max.*	0.35 *per cent max.*	0.45 *per cent max.*	0.50 *per cent max.*
A27-36T	A95-36	QQS-681a-1§	QQS-681a-2**	QQS-681a-O	QQS-681a-3
A87-36		49S11-B		49S11-C, D	49S11-A
49S11-C					
QQS-681a-4					
49S11-Bs, F					
AREA					
AAR-M201-36					

§ See note * under manganese.
** See note † under manganese.

Silicon

Not specified	0.40 *per cent max.*	0.45 *per cent max.*	0.50 *per cent max.*
A27-36T	49S11-B, C	QQS-681a-2	QQS-681a-1
A87-36			
QQS-681a-0, 3, 4			
49S11-A, Bs, D, F			
AREA			
AAR-M201-36			

Sulphur

0.05 *per cent*	0.06 *per cent*	0.08 *per cent*
A87-36T	A27-36T	QQS-681a-O
QQS-681a-4	A87-36, Acid	49S11-C
49S11-F	A95-36	
AAR-M201-36, Basic	QQS-681a-1, 2, 3	
	49S11-A, B, Bs, D	
	AREA	
	AAR-M201-36, Acid	

Manganese

Not specified	0.50 *per cent min.*	0.60 *per cent max.*	0.70 *per cent max.*	0.75 *per cent max.*	0.80 *per cent max.*	0.85 *per cent max.*	1.00 *per cent max.*
A87-36, C	A95-36	QQS-681a-1*	QQS-681a-2†	49S11-B‡	49S11-C	A87-36, A, A2, B	A27-36T
QQS-681a-3, 4						AAR-M201-36, A, B	QQS-681a-O
49S11-A, Bs, D, F							AREA
AAR-M201-36, C							

* For each 0.01 per cent C under 0.30 per cent,—0.025 per cent Mn may be added, up to 0.85 per cent.
† For each 0.01 per cent C under 0.35 per cent,—0.025 per cent Mn may be added.
‡ Mn + Ni must be below 1 per cent. For ordnance castings, this applies only to Class BW. For ordnance Class B castings, 1 per cent Ni is allowed.

Nickel

Not specified	0.40 *per cent max.*	0.50 *per cent max.*	1.00 *per cent max.*
A27-36T	49S11-B*†	QQS-681a-1*‡	QQS-681a-2
A87-36			
A95-36			
QQS-681a-0, 3, 4			
49S11-A, Bs, C, D, F			
AREA			
AAR-M201-36			

*†See note ‡ under manganese.
*‡For ordnance castings, 1 per cent Ni is allowed.

Copper

Not specified	0.25 *per cent max.*	0.30 *per cent max.*	0.50 *per cent max.*
A27-36T	49S11-B	QQS-681a-1	QQS-681a-2
A87-36			
A95-36			
QQS-681a-0, 3, 4			
49S11-A, Bs, C, D, F			
AREA			
AAR-M201-36			

Other Elements—Each

0.25 *per cent max.*		
QQS-681a-1, 2	A87-36 AAR-M201-36	Call for annealing lugs; allow grouping of melts under certain circumstances; allow test to destruction on castings under 150 pounds.
49S11-B	AAR-M201-36	"A" grade to be shipped without annealing only when so specified on order.
	A95-36	Allows only electric, open hearth, or "other process approved by purchaser". Calls for hydrostatic tests.

Miscellaneous Requirements

QQS-681a 49S11	}	Have restrictions on welding; have provision for radiographic and other nondestructive tests, when specified in order, or in connection with permission to make weld repairs; call for inspection in the green; have restrictions on normalizing.
AREA		Allows only full annealing.

"Specs"

(*Concluded from page* 26)

one with a minimum elongation of 22 per cent and minimum reduction of area of 30 per cent; one with minima of 24 per cent and 35 per cent for these properties, and in addition a bend test of 120 degrees for two of the three classes included; and one requiring 26 per cent minimum elongation, and 38 per cent reduction of area.

The 70,000 pounds per square inch tensile strength group also is followed readily, though in this case the writers of the specifications seem to have found it more difficult to agree upon desirable minimum figures, since the possible spread for yield point in this group is very wide, in spite of the fact that the elongations specified cover a range of only from 20 to 24 per cent, or a spread of the same width as that of the 60,000 pounds per square inch group, which runs from 22 to 26 per cent. It is interesting, too, to note that in this group a minimum reduction of area of 30 per cent is called for in five of the eight classes covered, the other three requiring 36 per cent. This spread of 6 per cent is obviously narrower than that of 30 to 38 per cent allowed for the 60,000 pounds per square inch tensile strength group.

In the present article, it is not the intention to comment upon the reasons for the variations in these requirements, nor to dwell upon the origin of the specifications themselves. A short study of Tables I and II on pages 83 and 84 and the charts on page 27, however, immediately gives rise to a variety of reflections that will be covered in further installments. These summaries are offered here to the steel foundry brotherhood in the hope of somewhat lightening the burden of those who have the task of producing steel castings to meet specific requirements.

Table II appears on page 84

Repairs Equipment

General Time Service, recently has been organized at 1507 West Vliet street, Milwaukee, to specialize in repairing and reconditioning time telling and recording equipment requiring fabrication of obsolete parts, wheels, pinions, gears, etc.

Thirty-ninth convention of the International Acetylene association will be held in Houston, Tex., March 8, 9 and 10, 1939. Headquarters will be at the Rice hotel.

Table II

Summary of Various Specifications for Steel Castings

American Society for Testing Materials Castings for Miscellaneous Industrial Uses A27-36T
American Society for Testing Materials Castings for Railroads A87-36
American Society for Testing Materials Castings for Valves, etc. for High Temperatures A95-36
Federal Steel Castings QQ-S-681a
Navy Dept. Steel Castings 49Sli
Association of American Railroads Steel Castings M-201-36
American Railway Engineering Association Steel Castings for Bridges ..... Nov. 1937

†Tentative.

Specifications	Class	T. S.	Y. P.	Ext. %	R.A.%	Bend	P	S	Si	Mn	C	Cu	Ni	O.E.
A27-36-T	A1 Unannealed	60,000	30,000	22	30	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	A2 Normalized	60,000	30,000	26	38	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	A3 Full Annealed	60,000	30,000	24	35	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	B Normalized	70,000	38,000	24	36	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	B1 Full Annealed	66,000	33,000	22	33	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	B2 Full Annealed	70,000	35,000	20	30	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	H Normalized	80,000	43,000	17	25	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A27-36-T	H1 Full Annealed	80,000	40,000	17	25	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A87-36	A1	60,000	30,000	22	30	...	.05	.06	.....	1.00 Max.	.....	.....	.....	.....
A87-36	A2	60,000	30,000	26	38	...	.05]		.....	.....	.....	.....	.....	.....
A87-36	B	70,000	38,000	24	36	...	.05	Basic .05	.....	.85 Max.	.....	.....	.....	.....
A87-36	Alloy C	90,000	55,000	22	40	...	.05	Acid .06	.....	.85 Max.	.....	.....	.....	.....
A95-36		70,000	36,000	22	30	(90)	.05		.....	.85 Max.	.....	.....	.....	.....
QQS681a	0	(55,000)	(25,000)	(15)	(25)	...	.05	.06	.20 Min.	.50 Min.	.15 .45	.....	.....	.....
QQS681a	1	60,000	30,000	24	35	120	.07	.08	.....	1.00 Max.	.....	.....	.....	.....
QQS681a	2	70,000	40,000	24	30	120	.05	.06	.50 Max.	.60 Max.	.45 Max.	.....	.....	.....
QQS681a	3	80,000	40,000	17	25	...	.05	.06	.45 Max.	.70 Max..	.30 Max.	.30 Max.	.50 Max.§	.25 Max.
QQS681a	Alloy 4	85,000	53,000	22	35	120	.05	.06	.....	.....	.35 Max.§	.50 Max.	1.00 Max.	.25 Max.
49Sli	A	80,000	45% T.S.	17	25	...	.05	.05	.....	.....	.50 Max.	.....	.....	.....
49Sli	B	60,000	45% T.S. over 30,000	24	35	120	.05	.06	.....	.....	.....	.....	.....	.....
49Sli	Bs						.05	.06	.40 Max.	.75 Max.‡	.50 Max.	.....	.....	.....
49Sli	C	70,000	40,000	24	30	120					.30 Max.	.25 Max.	.40 Max.‡	.25 Max.
49Sli	D	(55,000)	(25,000)	(15)	(25)	...	.05	.06	.....	.....	.....	.....	.....	.....
49Sli	Alloy F	70,000	45% T.S.	20	30	120	.07	.08	.40 Max.	.80 Max.	‡	.....	.....	.....
AREA Bridges		85,000	53,000	22	35	120	.05	.06	.....	.....	.45 Max.	.....	.....	.....
AARM201-36	A Unannealed	66,000	33,000	22	33	...	.05	.05	.....	.....	.45 Max.	.....	.....	.....
AARM201-36	A Annealed	60,000	30,000	22	30	...	.05	.06	.....	.....	.....	.....	.....	.....
AARM201-36	B	60,000	30,000	26	38	...	.05]		.....	1.00 Max.	.....	.....	.....	.....
AARM201-36	Alloy C	70,000	38,000	24	36	...	.05	Basic .05	.....	.85 Max.	.....	.....	.....	.....
		90,000	55,000	22	40	...	.05	Acid .06	.....	.85 Max.	.....	.....	.....	.....
							.05		.....	.....	.....	.....	.....	.....
A87-36	Alloy C)	90,000	55,000	22	40	...								
AARM201-36	Alloy C)													
QQS681a	Alloy 4)	85,000	53,000	22	35	120								
49Sli	Alloy F)													
A27-36T	H	80,000	43,000	17	25	...								
QQS681a	3	80,000	40,000	17	25	...								
A27-36T	H1	80,000	40,000	17	25	...								
49Sli	A	80,000	(45% T.S.)	17	25	...								
QQS681a	2	70,000	36,000	24	30	120								
49Sli	Bs	70,000	40,000	24	30	120								
A27-36T	B	70,000	38,000	24	36	...								
A87-36	B	70,000	38,000	24	36	...								
AAR-M201-36	B	70,000	36,000	22	30	(90)								
A95-36		70,000	35,000	20	30	...								
A27-36T	B2	70,000	(45% T.S.)	20	30	120								
49Sli	D		31,500											
AREA Bridges		66,000	33,000	22	33	...								
A27-36T	B1	66,000	33,000	22	33	...								
A27-36T	A3	60,000	30,000	24	35	...								
QQS681a	1	60,000	30,000	24	35	...								
49Sli	B	60,000	(45% T.S.)	24	35	120								
A27-36T	A1		over 30,000		35	120								
A87-36	A1	60,000	30,000	22	30	...								
AAR-M201-36	A Unannealed	60,000	30,000	22	30	...								
A27-36T	A2	60,000	30,000	22	30	...								
A87-36	A2	60,000	30,000	26	38	...								
AAR-M201-36	A Annealed	60,000	30,000	26	38	...								
QQS681a	O	(55,000)	(25,000)	(15)	(25)	...								
49Sli	C	(55,000)	(25,000)	(15)	(25)	...								

*For each .01% C under .30%, .025% Mn may be added, up to .85%.
†For each .01% C under .35%, .025% Mn may be added.
‡Mn plus Ni must be below 1%. For ordnance castings, this applies only to class BW. For ordnance class B castings, a maximum of 1% Ni is allowed.
§For ordnance castings, a maximum of 1% Ni is allowed.
OE. Other elements.

Miscellaneous Requirements

AARM201-36) A87-36 (	Call for annealing lugs. Allow grouping of melts under certain circumstances. Allow test to destruction on castings under 150 lbs.
AAR-M201-36	"A" grade to be shipped without annealing only when so specified in order.
A95-36	Allows only electric, open hearth, or other process approved by purchaser. Calls for hydrostatic tests.
QQS681a) 49Sli (	Have restrictions on welding; have provision for radiographic, and other non-destructive tests, when specified in order or in connection with permission to weld; call for inspection in the green; have restrictions on normalizing.
AREA	Allows only full annealing.

Figures in ( ) No test unless specified in order.

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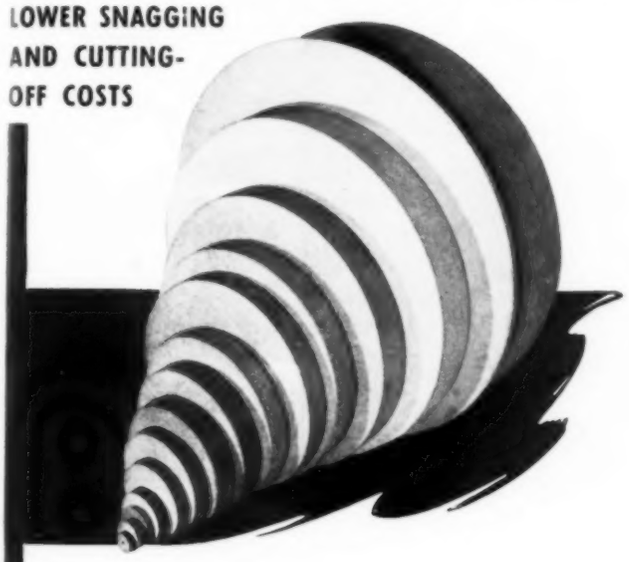

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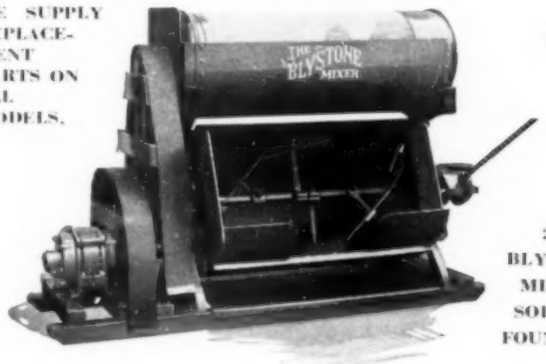

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3 methods by which a foundry can send its production costs down! ....down! ....down! ....down!

In the interests of lower production costs during 1939, we remind you of these three famous products for the foundry:

1. REVIVO BOND

With this mostly widely used clay bond in America, you may, literally, manufacture your own synthetic sand to meet your own requirements. One ton of your old, burnt sand can be rebonded for $1.00 per ton or less, including materials, labor, maintenance and power costs. Subtract that from your present cost of new sand and see the saving!

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3. REVIVO CORE PASTE

Some core pastes are good for air-dried jobs and other pastes for oven dried jobs. Revivo Core Paste develops far higher strength than any of the 17 competitive pastes tested *both* air dried and oven dried. It is outstanding for its strength and stability in contact with molten metal.

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Address

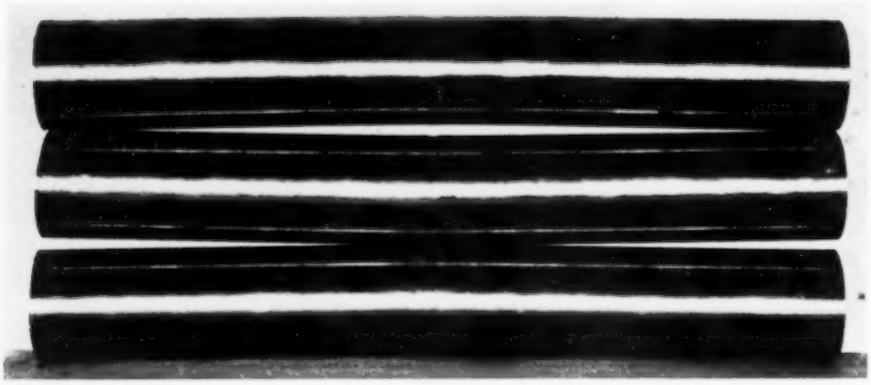


Fig. 19—Impact bars from heats No. 1265, 1267 and 1268 withstood full impact of the testing machine (120 ft. lb.) without breaking

High Strength Iron

(*Continued from page* 31)

and impact resistance of the 1.2-inch bar, raising the hardness to 461 as compared to the plain nickel-molybdenum irons (heat No. 1228), which had a brinell hardness of 325. The 2-inch bar containing 0.20 per cent chromium exhibited an increase in all physical properties as compared to the 2-inch bar of heat No. 1228. The addition of 0.20 per cent chromium to the plain nickel-molybdenum composition has changed the structure of a 1.2-inch test bar from an acicular matrix free from massive carbide to one containing appreciable amounts of carbide. In the 2.0-inch section the chromium addition has effected little change in the structure.

It is to be noted that additions of small percentages of vanadium increased the quantity of martensite present in the matrix and improved all physical properties both in the 1.2-inch and the 2.0-inch sections, without materially affecting the hardness. Raising the carbon to 2.90 per cent, the manganese to 1.50 per cent and the molybdenum to 1.50 per cent results in better physical properties in both sizes and section, the structure of the matrix being martensite (heat No. 1231—Figs. 17 and 18).

The dendritic pattern evident in the microstructures of these irons (heats No. 1228 to 1231) was probably due to the higher temperature of superheat, namely 2800 degrees Fahr. This structure is undoubtedly responsible for the lower impact resistance of these irons. The major portion of the ferrosilicon (1.50 per cent) was added about 15 minutes before pouring in the production of each of the four heats. Evidently, when ferrosiiicon is added too long before tapping, its effectiveness in breaking up the dendritic pattern is lost.

Wear tests were run on two of the irons in both sections to study the difference in wear resistance as affected by structure. The data were obtained in a General Motors lubricated wear testing machine, and results are presented in Table VI.

The specimen No. 1299—1.2-inch section had practically the same hardness as specimen No. 1268—2.0-inch section, but differed in microstructures (See Figs. 1, December issue and 21). The acicular matrix evidently offers approximately twice the resistance to wear that the pearlitic matrix offers. Although specimen No. 1299—2-inch was some 31 points lower in brinell hardness than specimen No. 1299—1.2-inch, the wearing qualities were about the same.

Dendritic Patterns Weaker

The detrimental effect of the dendritic graphite pattern is clearly evident from a comparison of irons No. 1228 and No. 1230 with No. 1265 and No. 1267. The irons containing the dendritic graphite pattern are weaker in both section sizes and show much lower impact properties, although the compositions, brinell hardnesses and the microstructures of the matrices are practically the same.

A study of Table VII reveals the ability of molybdenum to reduce sensitivity to section size. Heat No. 1304 with 2 per cent molybdenum produced the same hardness in 1.2-inch section as in 2-inch section with practically equivalent tensile strength. The 1.2-inch and 2.0-inch sections of heats No. 1266, 1267, 1268, 1230 and 1303 differed in brinell hardness from 9 to 24 points.

A comparison of heats No. 1228 and 1229 shows the effect of 0.21 per cent chromium on the sensitivity of these irons to section size. The difference in hardness between 1.2-inch section and 2.0-inch section was about 130 brinell numbers in heat No. 1229, whereas the difference in hardness between the same two section sizes in heat No. 1228 with no chromium was only 28 points. The increased hardness in the 1.2-inch section of heat No. 1229 was due to the presence of free carbides.

In the production of high strength cast irons where the carbon runs close to 2.5 per cent and silicon con-

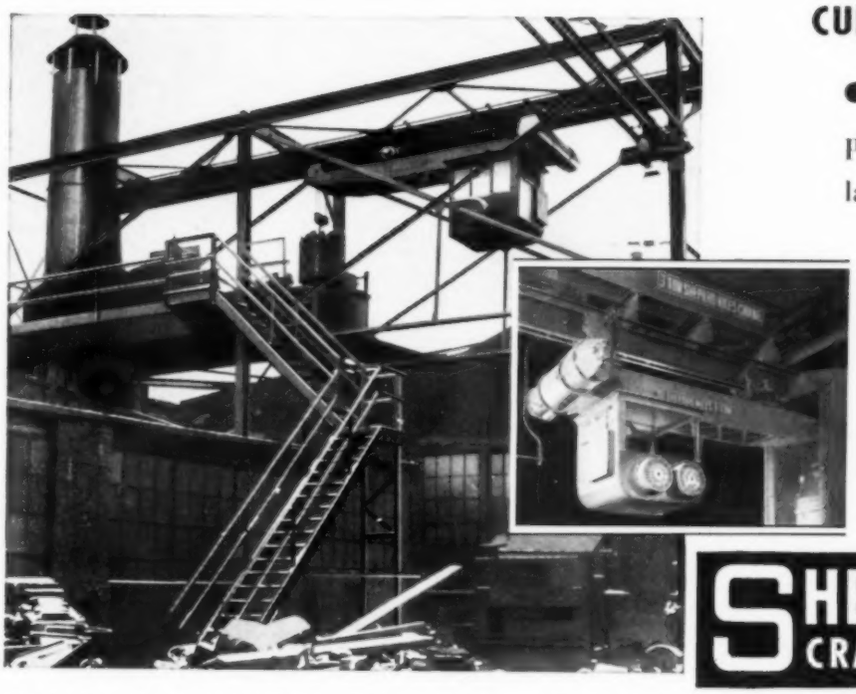
(*Concluded on page* 88)

Fig. 20 (Left)—Heat No. 1268, etched in 2 per cent nital, 500 diameters, 1.2-inch section

Fig. 21 (Right)—Heat No. 1268, etched in 2 per cent nital, 500 diameters, 2-inch section

BETTER CASTINGS AT LESS COST PER TON

... with SHEPARD-NILES CUPOLA CHARGING HOISTS



● Each charge is lowered in place, not dropped. Uniformly layered charges insure more even distribution of heat. Expensive charging floors are eliminated. Cupolas are charged faster and with fewer men—LESS cost per ton.

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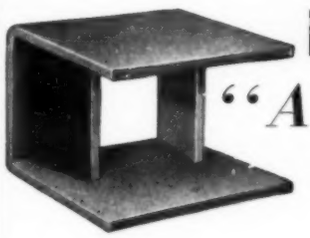

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(*Concluded from page* 86)

tent is approximately 2.75 per cent, the addition of 1 per cent molybdenum increases hardness and tensile strength, improves impact resistance, decreases the effect of size of section on hardness and changes a lamellar pearlitic matrix to an acicular matrix.

Further additions of molybdenum are effective in increasing these properties, but not so much so as the first 1 per cent.

The addition of 1 per cent nickel to the 1 per cent molybdenum iron increases the tendency to form acicular pearlite on cooling, which strengthens the iron, improves impact resistance of the iron and increases hardness and wear resistance.

The addition of copper to the 1 per cent molybdenum iron reduces the transformation rate of the austenite, causing the formation of martensite in small sections and an acicular matrix in heavier (2-inch) sections. Tensile strength and impact properties are likewise improved.

Manganese over 1.50 per cent increases hardness excessively, introduces machining difficulties, reduces impact resistance and shows poor tensile properties.

Superheat temperature should be kept low, probably around 2700 degrees Fahr. High superheat temperatures promote the formation of the dendritic pattern of graphite. This is particularly true when using all steel charge and producing low total carbon irons.

Late additions of large percentages of ferrosilicon should be made within 5 to 6 minutes before pouring, as a longer time apparently reduces its effect in breaking up the dendritic pattern. The detrimental effect of the dendritic pattern of graphite has been shown. It is essential in the production of these super cast irons that some program be established which will definitely eliminate the formation of that type of graphite.

For high strength and toughness in smaller sections (1 inch and under), chromium probably should not enter the composition; its presence promoting the formation of massive carbides and consequent lowering of the physical properties. In larger sections (2 inches and larger) small amounts of chromium are not detrimental and may actually increase the physical properties.

Although the wear data are incomplete, the results of the four tests run indicate that microstructure is an important factor to be considered in producing an iron of good wear resisting qualities, and that an increase in hardness alone is not sufficient to increase wear resistance. More particularly, it has been shown that an acicular matrix is more resistant to wear than the lamellar pearlite when the two are compared under lubricated conditions.

Table V

Alloy Additions Increase Physical Properties

Heat No.	1299	1266	1265	1305
Total Carbon	2.50	2.50	2.49	2.46
Combined Carbon	0.60	0.65	0.66	0.64
Graphitic Carbon	1.90	1.85	1.83	1.82
Manganese	0.98	0.99	0.97	1.06
Silicon	2.82	2.80	2.71	2.59
Molybdenum	....	1.04	1.03	1.01
Nickel	....	....	1.01	....
Copper	....	....	....	1.06
Brinell Hardness				
1.2-inch Section	285	302	331	352
2.0-inch Section	255	286	302	302
Tensile Strength				
1.2-inch Section	69,800	74,100	80,500	81,500
2.0-inch Section	54,680	74,800	65,500	67,400
Impact				
1.2-inch Section	....	118.1	106.9	....
2.0-inch Section	44.4	113.1	120+	120+

Table VI

Results of Wear

Heat No. 1299	Brinell hardness	Wear, grams loss in weight
1.2" section	286	0.044
2.0" section	255	0.044
Heat No. 1268		
1.2" section	302	0.019
2.0" section	293	0.019

Book Review

Grinding Wheels and Their Uses, by Johnson Heywood, fabrikoid, 374 pages, 6 x 9 inches, published by the Penton Pubishing Co., Cleveland, and supplied by THE FOUNDRY, Cleveland, for $3, and in Europe by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, London, England.

Every individual who comes into contact with abrasive grinding, whether he be shop executive, grinding machine operator, or student in technical and trade school or in college, will find this book extremely valuable. It is the outstanding textbook and handbook on modern grinding and polishing practice and theory, and is based upon the operating experience of hundreds of engineers, designers, foremen and employes engaged in the abrasive field.

The book is divided into 23 chapters covering every phase of grinding. Internal, cylindrical, surface, roll and cam, eccentric and other out-of-round surface grinding are treated in separate chapters. The author discusses abrasive materials, how grinding wheels are made, and the theory of grinding. Polishing and buffing materials are described, and preparation of polishing wheels is explained. Throughout the book methods by which grinding output can be increased and the required finish obtained at the lowest overall cost, are stressed.

Numerous production-speeding, and cost-cutting methods, and kinks are described. Figures are cited which prove that use of modern methods increases production and reduces costs. Wheel recommendations for various types of grinding are presented in tabular form, and include the kind of abrasive, grain, grade and bond for the particular material and type of operation. The text is supplemented with data on care and safe use of grinding wheels, wheel breakage and safety, and a glossary of tradenames.

Opens Office

Kerchner-Marshall Co., Pittsburgh and Cleveland, recently opened a Detroit office in charge of Don E. Perkins. The company's products include pig iron, coke and foundry specialties.

Bureau of Mines, Washington, has published technical paper 582 on "Methods for the Detection and Determination of Carbon Monoxide" by L. B. Berger and H. H. Schrenk. Copies of the paper may be obtained from the superintendent of documents, Washington, for 10 cents.

Table VII

Sensitivity

Least Sensitivity to Section Size

Heat No.	Mo	Ni	Difference in BHN 1.2"	2.0"	Diff.
1266	1	....	302	286	16
1268	1	1...	302	293	9
1267	1	1...	321	302	19
1230	1	1...	335	321	24
1303	1.5	.....	341	321	20
1304	2.0	.....	341	341	0

Greatest Sensitivity to Section Size

Heat No.	Difference in BHN 1.2"	2.0"	Diff.
1229, Cr	461	331	130
1302, 2 Mn	429	363	66

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Is impervious to moisture.
Reduces metal and sand fusion.
Does not contaminate molding sands.
Particles are spherical and pass a 200-mesh screen.

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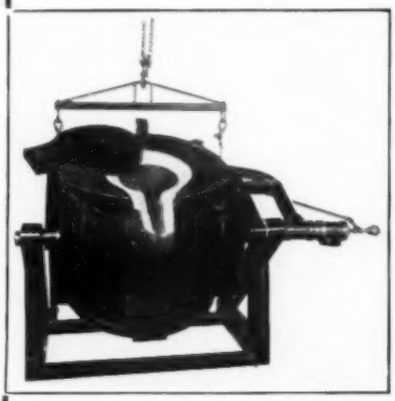

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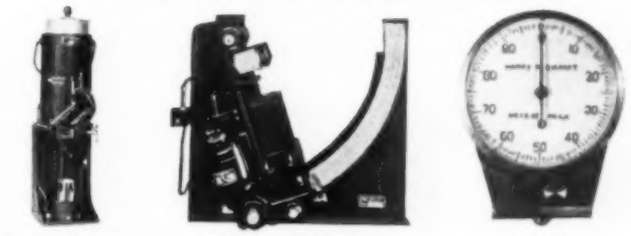

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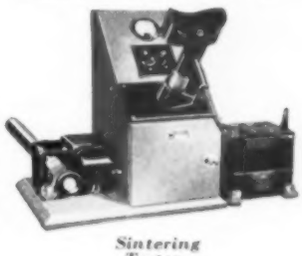

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OBITUARY

CARLETON S. KOCH, co-founder and president, Fort Pitt Steel Casting Co., McKeesport, Pa., died Dec. 18 in Edgewood, Pa. Mr. Koch was born in Buffalo, and was graduated from the school of mining and metallurgy, Massachusetts Institute of Technology, Cambridge, Mass., in 1898. For a time he was instructor

Carleton S. Koch

in metallurgy at Massachusetts institute, and in 1899 entered the foundry field with William Sellers & Co. Inc., Philadelphia; later becoming superintendent of that firm's foundry. Mr. Koch then joined the American Radiator Co., as assistant manager of its Titusville, Pa. plant. In 1903 he was made manager of the Franklin, Pa. plant of the American Steel Foundries; later becoming manager of its Sharon, Pa. plant.

In 1906, with the late W. L. Curry, Mr. Koch organized the Fort Pitt Steel Casting Co., becoming president and general manager. He held those positions continuously except in 1918 when he became one of the few civilians in an executive capacity in the Ordnance department. Mr. Koch was president of the American Foundrymen's association in 1919, and a director from 1918 to 1923. He was a vice president of the National Founders' association in 1927. In addition to being on honorary member of the A. F. A., he was a member of the American Iron and Steel institute, American Society for Testing Materials, American Institute of Mining and Metallurgical Engineers, and Society of Engineers of Western Pennsylvania.

* * *

Samuel K. Nutter, 57, president, Old Colony Foundry Co., East Bridgeport, Mass., died recently. Mr. Nutter had been with the Old Colony Foundry Co. for 30 years, devoting his time to sale of castings.

* * *

Charles H. Sawyer, 68, treasurer, Fields Corner Brass Foundry, Dorchester, Boston, died Dec. 3.

* * *

George P. Ransom, president Ransom Grinding Machine Co., Oshkosh, Wis., died Nov. 27.

* * *

Thomas F. Stewart, foundry superintendent, Foster Machine Co., Elkhart, Ind., died Dec. 1.

* * *

E. H. Chapin, 71, president of National Car Wheel Co., died at his home in Geneseo, N. Y., after an illness of 3 months.

* * *

Hurlbut S. Jacoby, director of industrial research and field director of the engineering experiment station at Ohio State university, Columbus, O., died Nov. 16.

* * *

Ralph C. Velte, 55, vice president, Valley Mould & Iron Corp., Hubbard, O., died Dec. 20. Mr. Velte had been connected with the Valley Mould & Iron for the past 20 years.

* * *

Eugene Victor Ronceray, president and managing director, S. A. des Etablissements Bonvillain et Ronceray, Choisy-le-Roi, near Paris, France, and a leader of the French foundry industry, died recently. He also was president and managing director, Universal System of Machine Moulding & Machinery Co. Ltd., London, England, and director of studies at the Foundry High School of Paris, France. Mr. Ronceray was born on Nov. 15, 1869, and received his engineering degree in 1891 from Ecole Nationale des Arts et Metiers, Chalons, France. From 1891 to 1897 he was professor at the Institution Parangon, near Paris, where he previously received his training. In 1897 he took a post with the Paris-Lyon-Mediterranean railroad, and later became associated with M. Bonvillain with whom he established the first manufacture of molding machines in France.

Mr. Ronceray had devoted the greater part of his life to foundry practice. He was one of the founders of the Association Technique de Fonderie de France, and was a past president. He was author of numerous articles, papers and lectures on foundry subjects. In 1907 he lectured in the United States in Pittsburgh, Boston, New York, and Providence, R. I. He presented a paper at the Foundrymen's congress in Philadelphia in 1907, and one at the convention at Rochester, N. Y., in 1922. He took an active part in various conventions of foundry associations in Belgium, Great Britain, Czecho-Slovakia, and France.

He was on the organizing committees of various foundry exhibitions and conventions including the exhibition at Torino, Italy in 1911, and the International congresses in France in 1913 and 1923. In 1921 Mr. Ronceray originated the idea of a

Eugene V. Ronceray

special foundry school in a lecture he delivered in Liege, Belgium. Three years later the first foundry school was inaugurated in Paris. During the International congress of Paris in 1923 he created the international committee in charge of new testing methods for cast iron with representatives from America, Belgium, Czecho-Slovakia, France, Great Britain, Italy, Spain, Germany, Poland, and Switzerland. Mr. Ronceray was awarded the J. H. Whiting gold medal of the American Foundrymen's association at the convention held in Detroit in 1926.

* * *

August A. Hoffman, 49, president, United States Aluminum Match Plate Co., Cleveland, died Dec. 3. Mr. Hoffman was born in Poland and came to Cleveland when 15. He was one of the organizers of the company

* * *

Jonathan Bartley, dean of the graphite and crucible industry, died Nov. 21. Mr. Bartley was born Nov. 12, 1850 and his first connection with the graphite industry was with Joseph Dixon Crucible Co., Jersey City, N. J., in 1888. In 1908 he organized the Jonathan Bartley Cru-

(*Concluded on page* 93)

ADVERTISING PAGES REMOVED

(*Concluded from page* 90)

cible Co., Trenton, N. J. During the war he built the Pettinos Brothers plant in Philadelphia and the Chicago Crucible Co.'s plant in Chicago. He was president of the Bay State Crucible Co. and in 1924 became vice president of Asbury Graphite Mills, Asbury, N. J. Mr. Bartley retired from active business in 1928.

* * *

PERCY C. DAY, 63, vice president and chief engineer, the Falk Corp., Milwaukee, and a prominent engineer in the development of gearing, marine and rolling mills equipment, died Dec. 7 at his home in Elm Grove, Wis.

* * *

Sherman Hathorne, 74, for 30 years superintendent of the jobbing department of Chicago Hardware Foundry Co., Chicago, died Dec. 20 in Jacksonville, Fla. Mr. Hathorne's home was in Waukegan, Ill., where he had lived since 1892. He retired from business in 1930.

* * *

Gustave R. Loesch, 68, founder and president, Lake Erie Foundry Co., 210 Chicago street, Buffalo, died Nov. 15 at his home in Buffalo. Mr. Loesch was born in Germany, March 1, 1870 and went to Buffalo when 16 years of age. For several years he was employed in local foundries and in 1907 established the Lake Erie Foundry Co.

* * *

Lewis A. Way, 59, died Nov. 24 at his home in Columbiana, O. Mr. Way was owner of the Columbiana Foundry Co. and was a member of the American Foundrymen's association. He had been active in the Pittsburgh district before he moved to Ohio.

* * *

Fred Frazer, president and principal owner of Frazer & Jones Co., Syracuse, N. Y., producer of malleable iron castings, died Dec. 12. Mr. Frazer was one of the pioneer producers of malleable iron castings in the United States, and for many years was active in the affairs of the malleable industry. He was born in Syracuse on April 5, 1855. He received his early education at the Manlius school, and completed his education under private tutors in Dessau, Germany. He returned to this country in 1875 when his father died, and took over the latter's interests in the business, then operating under the name of Frazer & Burns. That firm was founded by his father in 1845. Later the firm name was changed to Frazer, Burns & Jones, and still later was incorporated under its present name of Frazer & Jones Co.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

Cupola Practice

TO THE EDITORS:

A cupola operated under a standardized system will give good results with little variation in the analysis or physical properties of the iron. Operating a cupola in a haphazard manner is like flipping a coin. If it comes down right side up you win, but if not, you lose. I have standardized my methods, even though I have no special equipment, air weight control, volume gage, pressure gage or mixing ladle. This 48-inch cupola produces metal for diesel and gasoline engine castings weighing from ½ to 350 pounds. The charge contains 80 per cent scrap and the resulting iron meets specifications required for machinability and wear resistance.

The cupola is chipped out in the usual manner and any necessary repairs made to the melting zone with daubing and bricks. Tap hole and slag hole are repaired. Bottom doors are raised and propped and covered with sand rammed firmly, but not hard. The sand bottom is covered with dry wood followed by a supply of wood that will ignite the coke properly. The flat pieces of wood on the bottom prevent other pieces of wood on end from gouging holes in the sand. Large pieces of wood should be avoided. They may not burn away in time and thus may interfere later with the proper height of the coke bed.

About two thirds of the total bed charge of coke is placed on the wood which then is lighted and allowed to burn for 45 minutes. The remainder of the bed then is added and if necessary the wind is turned on until the entire bed is a bright red. The bed then is leveled off with additional coke to the proper height and charging may begin. With a coke bed the same height from day to day and with the coke splits weighed accurately, melting conditions will be uniform. It is necessary to have a reliable man on the platform who will see that charging is done properly.

Iron charges are made up on wood platforms and taken to the charging floor on a dolly. Close attention is required in weighing and placing the iron on the platforms so that the pig iron, steel and scrap are charged in proper sequence. Where heavy scrap is present it is placed in one charge and followed by a charge of light scrap. This prevents two heavy pieces of scrap from reaching the melting zone at the same time and thus slow the melting speed, affect the temperature of the iron and probably affect the analysis.

Wood platforms also are employed for transporting the coke from the yard to the charging platform. The platform holds four barrels. Each barrel is weighed and any necessary adjustment made in the content. A sufficient number of barrels are available for the entire heat. Thus there is no chance of a careless workman short weighing or over weighing the coke.

A dial on the charging floor is connected to a second dial on a post near the cupola spout so that the indicators on both move together. In the first charging operation, four charges fill the cupola to the charging door sill. The register is set on charge No. 4. Shortly after the wind goes on and the charge commences to settle, the charger puts in charge No. 5, but he does not register it on the dial until it has settled down to the level at which he commenced. Other charges are added and the indicator is moved until time to open the slag hole.

Ten minutes after the blast is turned on the first iron runs out of the tap hole and is allowed to run for four minutes before the tap hole is plugged. When the indicator shows that charge No. 7 is in the cupola, the tapper makes his first tap. Thereafter until the slag hole is opened, the cupola is tapped as soon as the dial shows that a new charge has been placed in the cupola. After the slag hole is opened, the cupola is tapped for the remainder of the heat just before the metal reaches the slag hole.

This method insures a uniform quality of metal. Each charge is 1000 pounds and the receiving ladles are each 1000 pounds capacity. The method takes care of any variation in melting time. If 4 minutes elapse before a charge is melted down, it is tapped in 4 minutes. If the time is 5 minutes, it is tapped in 5 minutes. In each case definite assurance is had that the entire charge is melted before it is tapped. I would like to have comment from other foundrymen in regard to standardized methods of operating a cupola under other conditions.

R. E. SHADWICK
Foundry Superintendent
Witte Engine Works
Kansas City, Mo.

European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Short Anneal

Pearlitic Short Anneal Malleable (Ueber perlitischen Schnelltemperguss), by R. Gnade, E. Piwowarsky and W. Felix, *Die Giesserei*, Duesseldorf, Germany, Sept. 23, 1938.

Through systematic changes in carbon, silicon, and manganese contents of an otherwise constant composition of a short annealable raw material, the authors endeavored to ascertain that material which exhibited the greatest independence of cooling or quenching speed to provide a predetermined pearlitic matrix without presence of free ferrite as well as free cementite. The best composition contained about 2.4 per cent carbon, 0.6 to 0.7 per cent silicon, and 0.7 to 0.8 per cent manganese.

Most favorable cooling or quenching speed is 80 to 100 degrees Cent. per hour. Tensile strength of the material was 60 to 70 kilograms per square millimeter (85,338 to 99,560 pounds per square inch) with an elastic limit over 40 kilograms per square millimeter (56,892 pounds per square inch), and 1.5 to 2 per cent elongation. Nickel alloyed melts in spite of remarkable refinement of temper carbon and fracture, gave only up to about 1.5 per cent nickel, certain advantages relating to the mechanical properties.

Alloy Iron

Alloy Iron, by W. L. Allen, *The Australasian Engineer*, Sydney, Australia, Oct. 7, 1938.

In this article the author discusses a number of alloy irons from the viewpoint of the underlying principles governing selection for a particular application. In heat resistance applications he refers to silal containing 5 to 7 per cent silicon; nicrosilal containing 5 to 6 per cent silicon, 18 per cent nickel, and up to 6 per cent chromium, and ni-resist containing 2 per cent silicon, 14.5 per cent nickel, 7 per cent copper and 2 to 3 per cent chromium. The first retains its strength and rigidity at high temperatures, and withstands continuously temperatures of 850 to 900 degrees Cent. without scaling or growth in the presence of CO_2 and SO_2.

However, silal does not stand up under thermal shock, and to overcome that brittleness nicrosilal was developed. That alloy is rendered austenitic by the nickel while the chromium controls the form of the graphite and enhances the heat resisting properties. However, if nicrosilal is held near the temperature range of 500 to 600 degrees Cent. a tempering effect with the production of martensite and embrittlement ensues unless the composition is controlled closely. Where service requirements are too severe for low alloyed irons, and where use of nicrosilal is not warranted, ni-resist can be used for temperatures to a maximum of 950 degrees Cent.

In corrosion the author states that the wide variety of conditions makes it impossible to suggest one alloy as a panacea for all ills. He mentions graphite softening in which the ferrous materials disappear, leaving only the graphite. In determining whether austenitic iron should replace cast iron, examination of the corroded surface will be of help. If the surface is hard and evenly corroded, cast iron whose matrix has been hardened with small amounts of nickel or copper may serve satisfactorily. With a pitted surface, and uneven corrosion showing soft spots, austenitic iron should be used.

The author discusses high test irons which can be heat treated. He follows with information on high duty irons. Difference between the two is based on tensile strength; high duty irons being those with tensile strength over 50,000 pounds per square inch. The two most widely known irons of that class are nitensyl and meehanite. Both irons are made from high steel scrap mixes which would give a white fracture as cast. In the case of ni-tensyl graphitization is accomplished by adding nickel and ferrosilicon to the molten stream while with meehanite calcium silicide is employed as the graphitizer.

Graphitization

The Process of Graphitization of Cast Iron (Ueber den Vorgang der Graphitisierung des Gusseisens), by E. Piwowarsky, *Stahl und Eisen*, Duesseldorf, Germany, Oct. 21, 1938.

After carefully investigating a wide variety of cast irons of varying compositions involving comparison of automatically registered cooling curves of liquid iron, and other considerations, the author concludes that justification of dual equilibrium diagram is less a question of heterogenous equilibrium than it is with the kinetics of the process in the liquid phase. Through evaluation of self-registered cooling curves of cast irons of various composition, the mechanism of cast iron graphitization can be followed and a crystallization diagram sketched which expresses the process for white or gray solidification.

Calculation of the energy change confirms the conclusions deduced from the cooling curves. Conditions under which graphitization results from carbide dissociation have been narrowed down and described. Abnormal ferrite formation in thin-walled cast iron is explained with respect to its cause, and depicted on a supplement of the existing cast iron diagram. It was shown conclusively that carbide reversion with ferrite formation occurring with excessive superheating is related to carbide dissociation.

Casting Growth

Growth of Cast Iron for Piston Rings at Temperatures to 700 degrees Cent. (Wachsen von Gusseisen fuer Kolbenringe bei Temperaturen bis 700°), by Franz Bollenrath and Karl Bungardt, *Stahl und Eisen*, Duesseldorf, Germany, Oct. 13, 1938.

Procedure of growth on some piston ring alloys containing about 3.8 per cent carbon, 3 per cent silicon, 0.8 per cent manganese, 0.7 to 1.0 per cent phosphorus, up to 0.5 per cent chromium, and 0.3 to 0.8 per cent molybdenum, was investigated by time and temperature relationships. Results indicate that speed of growth increases after heating begins, reaches a maximum after a definite heating time which is lowered by higher temperatures, and then with further heating again decreases. Below a certain temperature a measurable increase in length is observable only after a tempering period which becomes greater with decreasing temperature. Undecided therefore, remains the question whether in that tempering period no growth occurs or whether the speed of growth is so slight that the length increase lies without the range of precise evaluation. The temperature of growth initiation according to one investigation period of 700 hours lies between 400 and 450 degrees Cent.

High Strength

Structure Formation and Physical Properties of High Strength Cast Irons (Ueber Gefuegeausbildung und Festigkeitseigenschaften hochwertiger Gusseisensorten), by P. Bardenheuer and W. Broehl, *Mitteilungen* Kaiser Wilhelm Institut fuer Eisenforschung, 20, (1938), Lfg. 11, abstract in *Stahl und Eisen*, Sept. 15, 1938.

The authors investigated the relation between chemical composition, melting and freezing conditions on structure formation and physical properties with low carbon cast irons containing 1.5 to 3 per cent carbon, 1.2 to 4.8 per cent silicon, 0.75 to 4.5 per cent manganese, traces to 0.18 per cent phosphorus, and 0.015 to 0.08 per cent sulphur. Effect of heat treatment as well as behavior under impact were considered.

With decreasing carbon and silicon an increasingly favorable graphite formation and increasing physical properties were observed in which, with a very low carbon, a temper-form graphite occurred. Increasing manganese in sand castings increases tensile strength with the highest value at 1.2 per cent as cast; in heat treated specimens the high point is at 1.4 per cent. A slight decrease occurs with higher manganese. In chill cast pieces a decrease in tensile strength occurs by increasing manganese to 0.9 per cent. Brinell hardness increases with increasing manganese in heat treated specimens while with untreated specimens it decreased again to a high point at 1.2 per cent. Impact resistance reached the highest value at 1.4 per cent manganese.

Melts with high silicon and manganese (up to 4.8 per cent Si and 4.5 per cent Mn) showed—except for very low carbon content—great brittleness and hardness with decreased strength, regardless of mold form or heat treatment. High manganese reduces machinability severely. Investigation of some ladle additions after superheating indicated that through freezing of nuclei-free melts in consequence of undercooling, pseudo-eutectic with its overall unfavorable effect on physical properties, would be formed. Interaction between a low carbon melt and a mixture of soda and carbon in the ladle developed a structure of temper carbon and pearlite. Soda alone with higher carbon content material gave no results. Treatment with calcium-silicon of a high silicon melt gave only partial results; undercooling only could be restrained with sand cast test pieces, and not with chill casting.

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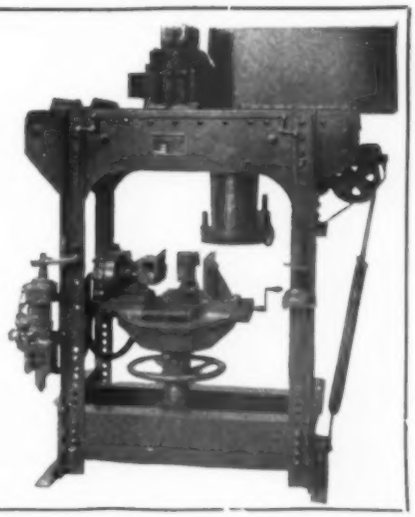

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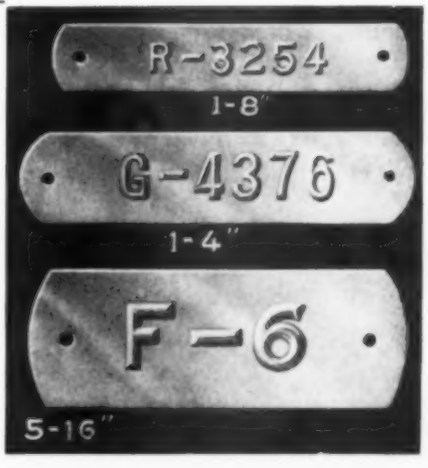
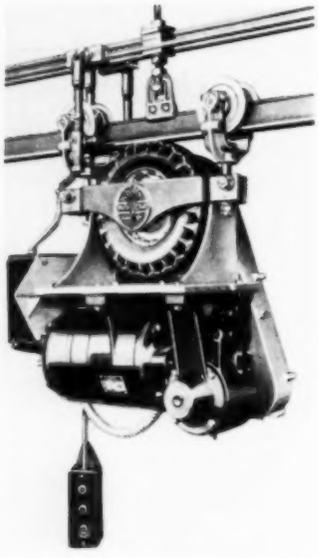


NEW EQUIPMENT and SUPPLIES

Motor Conveyor

Louden Machinery Co., Fairfield, Ia., announces the latest development in a powered machine for transporting loads over an overhead track system, including inclines. The unit which utilizes a rubber tire for the drive wheel, maintains uniform speed going down grade. Range of speed which can be provided is from 60 to 600 feet per minute. Movement is said to be smooth, quick and steady. The conveyor may be built into cab or step on platform so the operator can accompany loads if desired. Also it may be used in power driven cranes. Drive shaft is supported in ball bearings on each side of the wheel. Main frame is a one piece casting. The unit is balanced without need of counterweights or other additions to make it hang plumb.



The unit is driven through a rubber tire operating on the undersides of the track

Conveyor Belt

United States Rubber Products Inc., 1790 Broadway, New York, has added a crepe finish package conveyor belt to its regular line. This belt, developed after careful study to determine the type of surface providing the greatest degree of efficiency for incline surface requirements, has a crepe surface to provide special holding qualities. While the belt provides necessary roughness, it is pointed out the design is such that it can be easily cleaned. The belt is supplied on 28 ounce and 32 ounce duck with special crepe finish cover on the carrying side of the belt.

Die Grinders

Van Dorn Electric Tool Co., Towson, Md., recently has announced two new die grinders. Maximum wheel size of these grinders is 2 and 2½ inches and they operate at full load speeds of 12,000 revolutions per minute. Spindle housings are of steel with bearings mounted at extreme ends of spindle to absorb radial load. Motors for the grinders operate on both alternating and direct current. A ¼-inch single purpose chuck will accommodate wheels, pencil stones, rotary files and burrs. Overall lengths of the grinders are 9 and 14 inches and net weights are 2½ and 4 pounds.

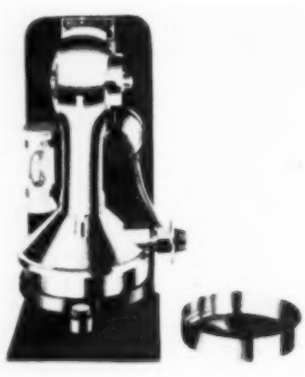
Chill Coating

Acheson Colloids Corp., Port Huron, Mich., recently has placed on the market a colloidal graphite for coating internal or external chills. It is claimed that the material contributes to heat transfer and also facilitates removal of the chill member from the casting. The chills are painted with an agglomerate free dispersion of colloidal graphite in water. Usually a half and half mixture is employed, but relative concentration may be varied to meet existing conditions. It is claimed that the inert and unctuous layer thus formed, provides both the desired chilling and parting effect.

Moisture Test

Harry W. Dietert Co., 9330 Roselawn avenue, Detroit, has designed an adjustable thermostatic control for its moisture teller. This thermostat automatically controls the dry-

(*Concluded on page* 98)



Device dries by forcing heated air through the sample of material

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This offers a convenient and economical means of sand preparation for the foundry of small or medium size.

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By Pat Dwyer

A COMPLETE encyclopedia, a ready reference and a practical guide to sound foundry practice. In addition to a description of every conceivable type of gate and riser, the text covers the application and function of gates and risers to all sizes and types of castings. Illustrations on almost every page enable the reader to grasp the salient points with a minimum of study.

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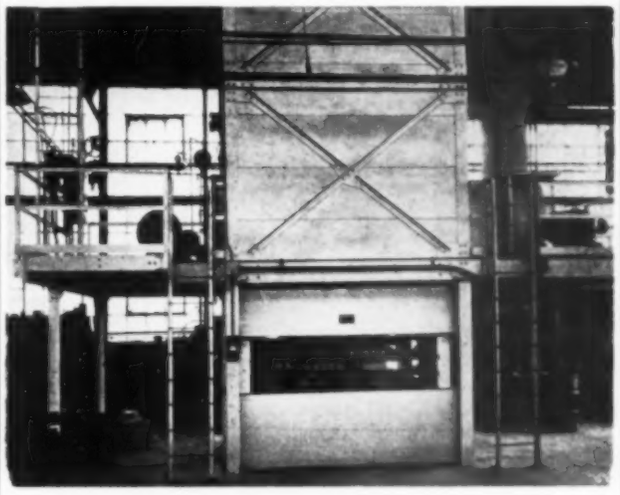

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(*Continued from page 96*)

ing temperature at any chosen temperature between 135 and 250 degrees Fahr. It is claimed that this is a desirable feature for drying samples of materials that are sensitive to temperatures at which they are dried. A thermometer indicates the temperature of the heated air forced through the material that is being dried for moisture determination. The thermostatic control materially increases the range of materials for which the moisture teller may be used to rapidly determine the exact moisture content.

Optical Protractor

Bausch & Lomb Optical Co., Rochester, N. Y., recently placed on the market a new optical protractor for measuring and checking angular relation between surfaces, edges and holes. The instrument is said to do the same work as the sine bar, allowing direct reading to replace a combination of mensuration and calculation. It is claimed that angles to 1 minute of arc can be read directly off the scale. The instrument is for application to jigs, fixtures, bench work and surface plates in tool room and production work.

Heating Units

General Electric Co., Schenectady, N. Y., has developed a new high-speed, high heat, calrod heating unit for industrial applications that require temperatures as high as 1500 degrees Fahr. Uses of the product include applications in high temperature air heating, industrial oven with air temperatures up to 1000 degrees Fahr., hotplates, and various metal surfaces. Standard listed ratings of the units range from 750 to 3500 watts and effective heating lengths range from 18 to 84 inches, but other sizes and ratings can be supplied. To fit the area to be heated, bends of ½-inch radii can be made in the unit.

Hardness Tester

Louis C. Eitzen Co., 280 Broadway, New York, has announced a portable brinell meter which simultaneously makes impressions in a reference bar and the material to be tested. The outfit consists of an instrument within which to nest a standard reference bar. That bar is supported in contact with a standard 10 millimeter steel brinell ball. The assembly is then placed in position on the surface of the metal to be tested. A plunger within the instrument is given a sharp blow with a hammer. The brinell ball produces a simultaneous impression in the bar and in the surface of the material under test. The impression diameters are then compared and by reference to a direct reading hardness table provided, the brinell hardness and tensile strength of the material is noted.

Idler Rolls

Link-Belt Co., 220 South Belmont avenue, Indianapolis, recently has placed on the market a ball bearing idler shown in the accompanying illustration and designed for use with light weight belt conveyors in widths from 14 to 24 inches. The rolls are 4-inches diameter smooth finished steel tubing with formed heads pressed into and welded to each end and fitted with ball bearings in a grease sealed labyrinth. Rolls are mounted close together in reinforced steel brackets welded to a steel mine-tie base.

Idler rolls are fitted with ball bearings

Slotted holes in the ends permit convenient adjustment of the supporting frame work. Slotted ends in the roll shafts provide a positive locked seat in the roll supporting brackets. Rounded, smooth rolls prevent injury to the conveyor belt and may be removed quickly. Small space between the rolls prevents creasing of the belt. A return roll idler is supported by reinforced steel hangers having slotted openings which serve as seats and anchors for holding the necked roll shaft in place.

Contact Control

Yale & Towne Mfg. Co., Philadelphia division, Philadelphia, has developed a new cam-operated contactor controller. Designed for use on electric trucks, this equipment is claimed to effect the make and break contacts without creating sticking or welding of electrical surfaces due to arcing. Magnetic blow-out assembly with die-molded asbestos arc chutes is designed to quench the arc quickly and increase the life of the contacts. Mechanical cam-operation is claimed to give high current interrupting capacity, positive action and greater safety.

Motor Equipment

Synchronous motor equipment for driving directly small air compressors recently has been placed on the market by Electric Machinery Mfg. Co., Minneapolis. The equipment consists of an exciter and field and line control units. Easier installation and smaller floor space requirements are claimed because the exciter is mounted on the motor and the controls enclosed and wall-mounted. Equipment is designed for compressors requiring as low as 40 horsepower.

Tiering Fork Truck

Elwell-Parker Electric Co., 4205 St. Clair avenue, Cleveland, recently placed on the market a new tiering fork truck with capacities from 3500 to 5000 pounds. Wheels are 20 x 7 inches and the truck is 2-wheel drive and steer. The power plant is equipped with a series wound, four pole, enclosed, heavy duty and high torque motor. Truck has a front wheel, spur gear drive and is designed with either a 41 or 50-inch wheel base. The manufacturer also has marketed a new high lift platform truck with a capacity of 4000 pounds, a 2-wheel drive and either 4- or 6-wheel steer depending upon whether the truck is equipped with a 2- or 4-wheel trail axle.

Protects Metals

Sherwin-Williams Co., Cleveland, has developed several new paints for protection of metals. These include two primers and one finish coating paint. One primer employs lead chromate and the other red lead. Advantages claimed for the paints are more complete exclusion of water and gases from the metal protected, greater durability, and improved appearance. The new paints also are said to be faster drying, easily brushed, and that weathering does not roughen the paint film.

Safety Clothing

American Optical Co., Southbridge, Mass., has introduced a new line of protective clothing, gloves, sleevelets, leggings, aprons, hats and hoods. These products are available in a variety of materials used to protect workmen from heat, fire, acids, cut, abrasions, etc. The materials used and the finished products are designed to provide maximum comfort and protection under specific conditions.

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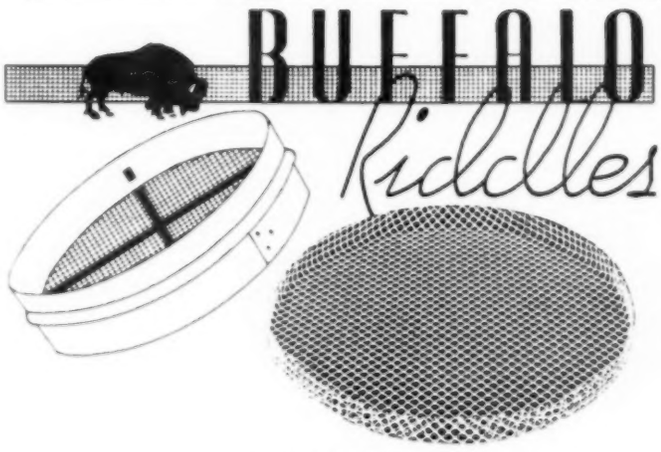

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FOUNDRY ACTIVITIES

CONSTRUCTION has begun on the new foundry of Marengo Foundry Co., Marengo, Ill. Light gray iron castings will be made in the plant and operations will begin Jan. 1, if the building can be made ready.

* * *

Reynolds Foundry & Machine Shop, East Jordan street, Greenville, Tex., recently has built the Bonham Foundry Co., Bonham, Tex. The new plant will produce light gray iron castings.

* * *

Ace Foundry, Ltd., 8240 South Alameda street Los Angeles, Calif., has been licensed by the Eaton-Erb Foundry division of Eaton Mfg. Co., 9771 French road, Detroit, to produce various types of castings in the permanent mold process of that company.

* * *

Higgins Foundry, 1244 Higgins street, Atlanta, Ga., was damaged by fire to the extent of $35,000.

* * *

Truel Foundry Co., 682 Raymond avenue, St. Paul, has been incorporated by F. A. Truel, Emil Strom and Fred Peterson.

* * *

Ward Foundry Co., Blossburg, Pa., recently suffered a loss of $500,000 through fire.

* * *

Central A—B Foundry, 145 Madison street, Cortland, N. Y., has been organized to produce aluminum and brass castings.

* * *

Brock Pattern Works, 212 Pacific, Houston, Tex., has acquired tract of land and will erect metal pattern plant costing $20,000 with building and equipment.

* * *

Western Gas division, of Koppers Co., Ft. Wayne, Ind., has been absorbed by the Bartlett Hayward division, Baltimore. Sales and engineering activities of the Ft. Wayne division were moved Dec. 1 to Balti-

(*Concluded on page* 102)

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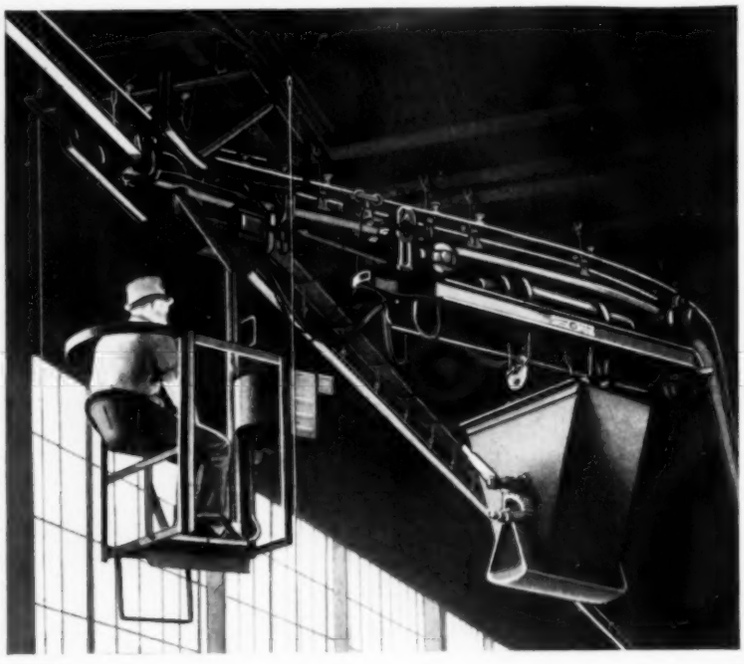

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No. 2 foundry, Buffalo	21.00
Basic, Buffalo	20.00
Basic, Valley	20.50
Malleable, Chicago	21.00
Malleable, Buffalo	21.50
Charcoal iron, furnace	25.00
Coke	
Connellsville beehive premium	$5.75 to $6.25
Wise county beehive coke	5.50 to 6.50
Detroit by-product delivered	10.25
Scrap	
Heavy melting steel, Valley, No. 2	$13.50 to $14.00
Heavy melting steel, Pittsburgh, No. 2	14.50 to 15.00
Heavy melting steel, Chicago, Auto No. 2	11.00 to 11.50
Stove plate, Buffalo	13.00 to 13.50
Stove plate, Chicago	8.50 to 9.00
No. 1 cast, mchy. New York	12.00 to 12.50
No. 1 cast, mchy., Chicago	12.00 to 12.50
No. 1 cast, Pittsburgh	15.25 to 15.75
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Birmingham	14.00 to 14.50
Car wheels, iron, Pittsburgh	15.00 to 15.50
Car wheels, iron, Chicago	13.50 to 14.00
Railroad malleable, Chicago	15.00 to 15.50
Malleable, Buffalo	13.50 to 14.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	10.77½
Straits tin	46.25
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	13.50 to 14.00
Lead, New York	4.85
Antimony, New York	11.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.50

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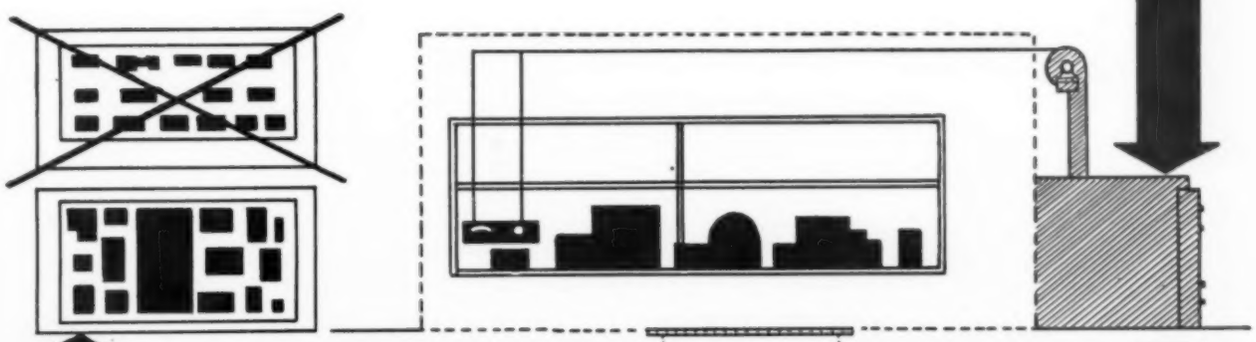
WILLSEA THERMO SIPHON SYSTEM



Permits effective, safe drying of large and small cores at the same time

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How to be Money Ahead on the

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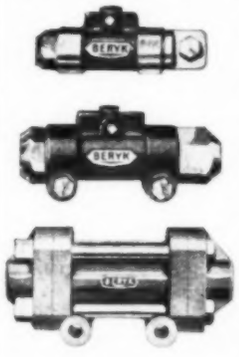

● Most foundry vibrators are good, but for 25 years **BERYK** has specialized in making them a little better, and longer-lasting. For instance, every **BERYK** is now constructed with a cast body of nickel-chrome-moly iron having a tensile strength of 50,000 lbs. per sq. in. and a precision ground piston of heat-treated, oil-hardened alloy steel. Efficient under all conditions and *operates in any position*. Available from ½" to 3" for all types of molding machines and pattern plates. *Fully guaranteed.* Your order shipped one hour after received. Folder and prices on request.

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All Grades—Carefully Controlled Heats
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Manufacturers of
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PIG IRON SPECIALTIES

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SMILLIE VENTS

for

- Greater Vent Area
- No loss of sand
- No Saggy Cores
- Longer Life
- Machinable for Contours
- Sturdy Construction

Sizes from ⅛" to 1" in ⅛" steps.

We also manufacture a complete line of Flask Pins and Bushings.

Samples and prices upon request

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520 E. Larned St. Detroit, Mich.

ADVERTISING PAGES REMOVED

(*Concluded from page* 100)

more, where they have been consolidated with the Bartlett Hayward division. Walter F. Perkins, vice president, Koppers Co., is in direct charge of the combined division, all products being manufactured, engineered and sold under his direction.

* * *

Plant of the Gurney Elevator Co., foot of Main street, Honesdale, Pa., has been leased by the Lummus Co., and the foundry has been discontinued.

* * *

Certificate to conduct business under firm name of Garvey Machine & Die Casting Co., San Gabriel, Calif., has been granted E. W. Shock, 2528 Ivar avenue, Hollywood, Calif.

* * *

Westminster Marine & Engineering Works Ltd., 736 Granville street, Vancouver, B. C., is planning to construct a brass and iron foundry and machinery manufacturing plant costing $40,000.

* * *

Meehanite Metal Corp., Pittsburgh, has licensed the following companies to manufacture castings under the Meehanite processes: Valley Iron Works, St. Paul, Minn.; Barnett Foundry & Machine Co., Newark, N. J.; Herbert Morris Ltd., Loughboro, England; Douglas Fraser & Sons Ltd., Arbroath, Scotland.

* * *

N & S Foundry Co., Seattle, is installing an electric arc furnace for making alloy and low carbon steels and alloy cast irons.

* * *

Olsen Engineering Co. contemplates reopening the Moline Plow Co. at Stoughton, Wis. The company will operate as small production castings jobbers, also as machinery builders.

* * *

Fire destroyed the power plant and pattern shop of the Ideal Foundry & Machinery division, Republic Steel Corp., Beaver Falls, Pa. The amount of damage was $50,000.

* * *

Ann Arbor Foundry Co., 1327 Mill street, Ann Arbor, Mich. has completed construction of a 48 x 111-foot addition to its foundry to replace section destroyed recently by fire. Addition is equipped with cupola and skip-hoist charger.

* * *

Cincinnati Milling Machine Co., Cincinnati, is planning to build a 400,000-square foot addition to its foundry for melting purposes. It will be erected in 100,000-square foot units according to Carlton E. Brown, plant engineer.

* * *

Index of foundry equipment orders for November, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 89.7 as compared with 87.9 in October and 128.03 in November, 1937. Index of shipments was 94.5 as compared with 93.4 in October and 178.8 in October 1937.

Why are Truscon Foundry Flasks popular with experienced molders? Note several reasons: *First,* Truscon Steel Flasks are easily rammed and shaken out. *Second,* every Truscon Flask is easy on the muscles because there isn't an ounce of unnecessary weight to handle. *Third,* Truscon Flasks are built to stand the hard knocks of continuous service.

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ALLOY STEEL FOUNDRY FLASKS

Trade Publications

METAL CEMENTS—Smooth-On Mfg. Co., 568 Communipaw avenue, Jersey City, N. J., has issued a revised and an enlarged edition of the Smooth-On handbook, describing all of the metal cement products produced by the company and illustrating their applications by working diagrams. Steps and relative advantages of various application methods are discussed. The materials are used most in stopping fluid and pressure leaks, tightening loose parts, repairing surface flaws on metal castings, etc.

HEAT TREATING — Surface Combustion Corp., Toledo, O., has issued a folder describing its new Char-Mo furnace to be used in the heat treating of molybdenum steel.

ALLOY—Magalloy, a 15-page booklet, has been issued by Magnesium Fabricators, division of Bohn Aluminum & Brass Corp., Adrian, Mich. The booklet describes characteristics of the alloy, illustrates its wide variety of applications and devotes several pages to data giving specifications on physical and mechanical properties together with general information on qualities of various alloys.